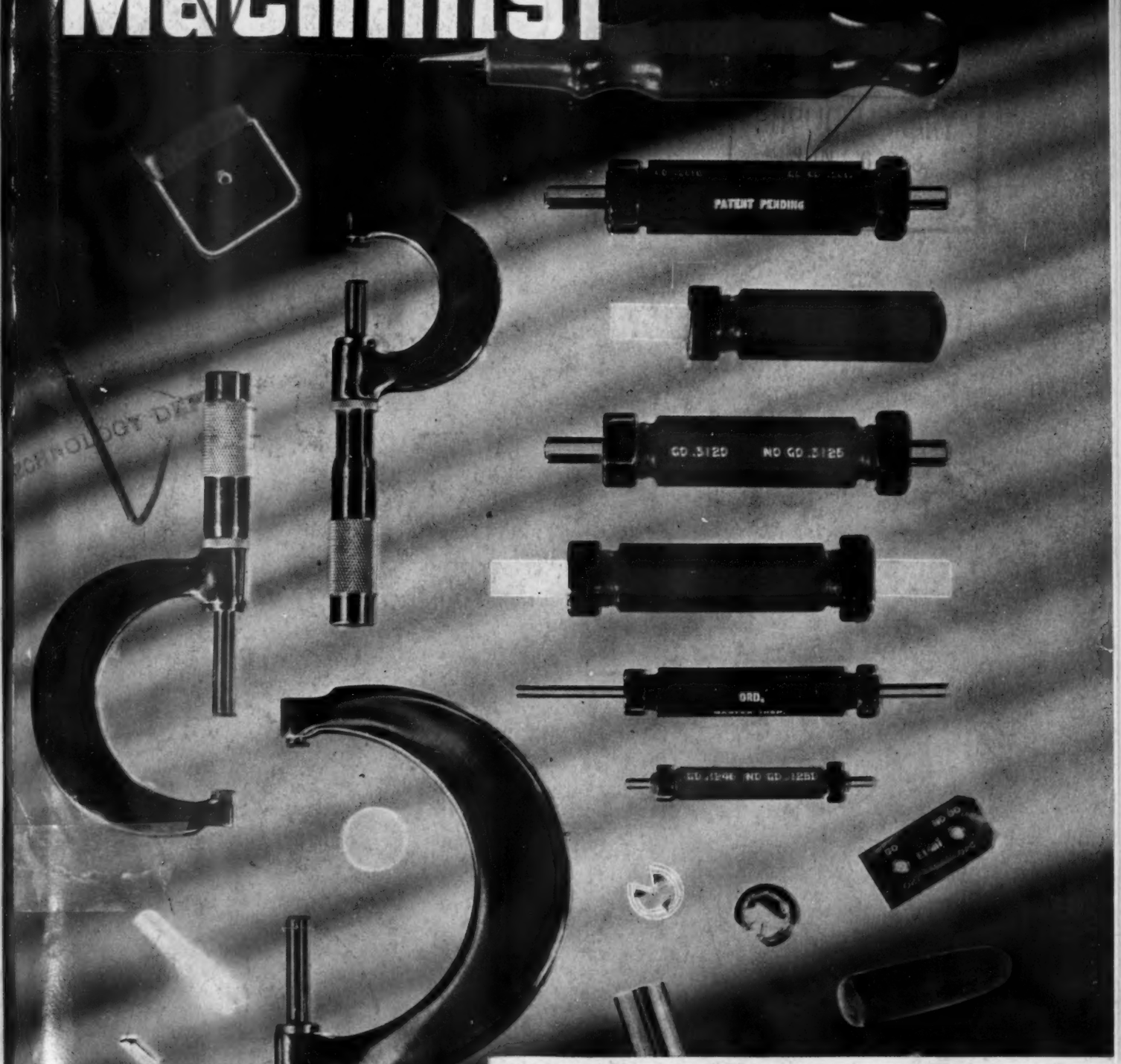
American Machinist

JUNE 6, 1946



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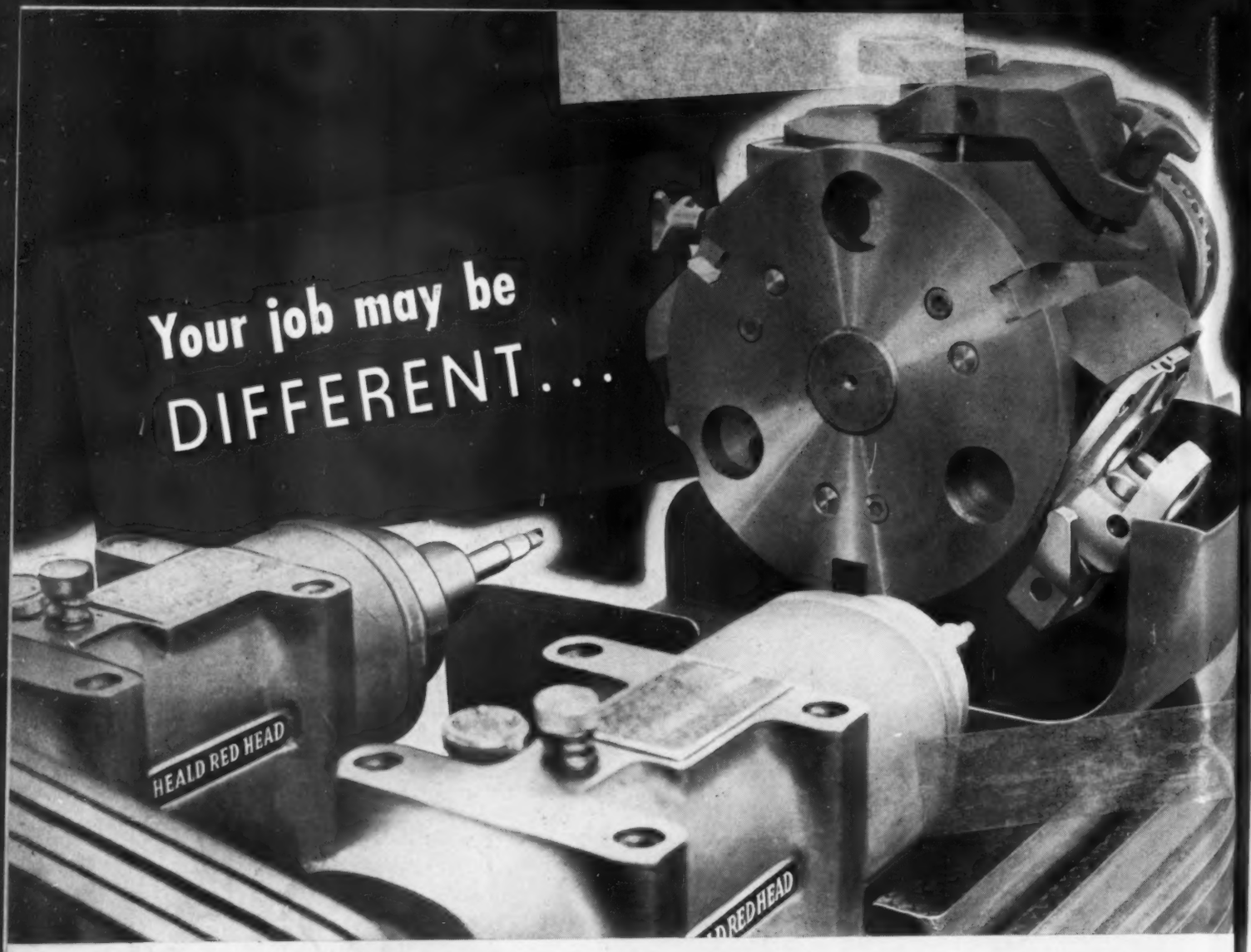

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Industrial Jewels . . . In our cover group of sapphire-tipt tools are: Left column, top to bottom: a contact point (boxed), 1-, 2- and 3-in. micrometer calipers, round flat, prism, and a tool-bit with the sapphire rod inclosed in a steel shell. Right column, top to bottom: burnishing tool, 0.2810-in. plug gage, two flat gages with an 0.3120-in. plug gage between, 0.140-in. plug gage, 0.125-in. plug gage; two button thread guides, a plate or double ring gage, and a V-block gage. The rough blank at right is a "boule," with the end of a rod below it; more convenient for phonograph needles, bearings, etc. (The red-colored synthetic sapphire is usually called "ruby.") Red handles are, of course, plastic, the gray ones flexible rubber. These tools from Elgin's Sapphire Products Division, and blanks from Linde Air, were kodachromed by McGraw-Hill Studios.

For Inventors . . . Our special report in this issue, combined and condensed by Associate Editor Corrado from various authorities, including Caspar Ooms, covers patents from employee-employer contracts to recent legislation. If you want, have or use patents, this is red meat. (It might even help L'il Abner's friend, Moonshine McSwine, patent his burglar trap [May 12 funny papers].)

The section tells how to get a patent, how to use one, how to set up a patent incentive system, how to get patent information and to protect an idea. It also covers problems of the inventor and the manufacturer, cross-licensing, "hoarding," current legislation, the compulsory licensing threat, the President's Patent Committee, and the new Patent Register. Reprints are available.

Cover Boy . . . Our heat-treating cover (April 25) has brought much favorable comment. Monarch Machine Tool presented a framed copy to the lad who posed for it at the company Open House on Sunday, May 5, before an audience estimated in five figures. . . . Also it will be reprinted for another company—the fifth of the first nine Kodachrome covers to win that distinction. The cover on this issue will be reprinted too, to make the sixth out of ten. . . . The printer just heaves a sigh and changes his press schedules, because such a cover takes five press runs. We heave one too, because paper is still scarce.

Reprints . . . We can't keep up with requests for extra copies of our special reports. For example, we've just gotten "How to Lubricate Metalworking Equipment" back into print, so "How to Work Stainless Steel" goes out of stock. The report on working with plastics is going fast, acclaimed as "the most practical material on the subject thus far" by men who work with these materials. . . . Naturally, we're tickled pink you like them. . . . We have a brand-new edition of the "Where-to-Buy Directory" ready, yours for the asking as long as they last.

German Tools-to-be . . . To fill out our report on Germany's postwar position, we've asked the McGraw-Hill Economics Staff to give us a roundup on Nazi tools and present Allied plans for control. This is for the man who's wondering what's what internationally.

Materials to be Handled . . . If we don't strip our gears, our special 32-page report (biggest thus far) on Modern Materials-handling Methods will feature the June 20 issue. Information has been collected over the past four years, digested over the past six months. The resulting compendium involves so many illustrations we've our fingers crossed until the issue is mailed.

Electrostatic Painting . . . How it's done and what it does—by Dr. Emery Miller, who knows—will be in our next issue. . . . There'll be a page of Short Cuts, more on diehead threading, electronics and hypoids, plus those regular departments to which you give such high votes. A Manufacturers' Literature insert and two pages of extra descriptions of new shop equipment will be in again too.

Hypoid Gear Expert... Ernest Wildhaber, born in Luzern, Switzerland, in 1892, and a graduate of the Federal Polytechnic Institute, Zurich, came to the United States in 1919. He worked first as a draftsman at SKF Industries, then as a mechanical engineer with Niles-Bement-Pond for three years. One of his attempts of becoming an independent inventor and consultant followed, lasting a total of six years. He joined the staff of the Gleason Works, Rochester, N. Y., in 1924, again in 1931, and has been there ever since. He is the author of the current series on hypoid gears.

Ernest Wildhaber has nearly 200 U. S. patents to his credit. He is the inventor of Gleason hypoid gears and their generating methods, the Gleason jobbing system for spiral bevel gears, the newer duplex method of cutting spiral bevel gears, the duplex methods for formate bevel and hypoid gear pairs, and many other innovations in gear design and manufacture.

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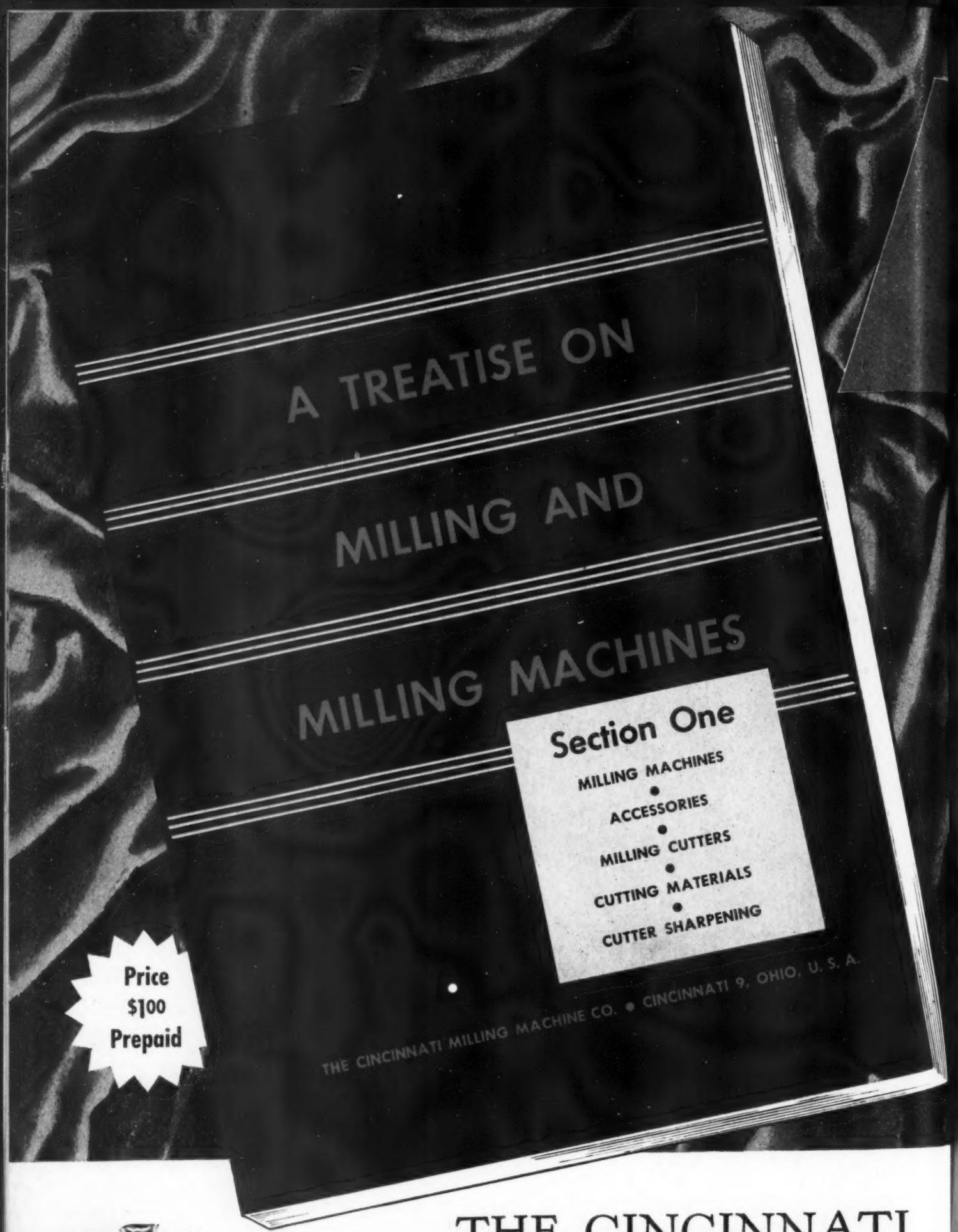


CINCINNATI

THE CINCINNATI

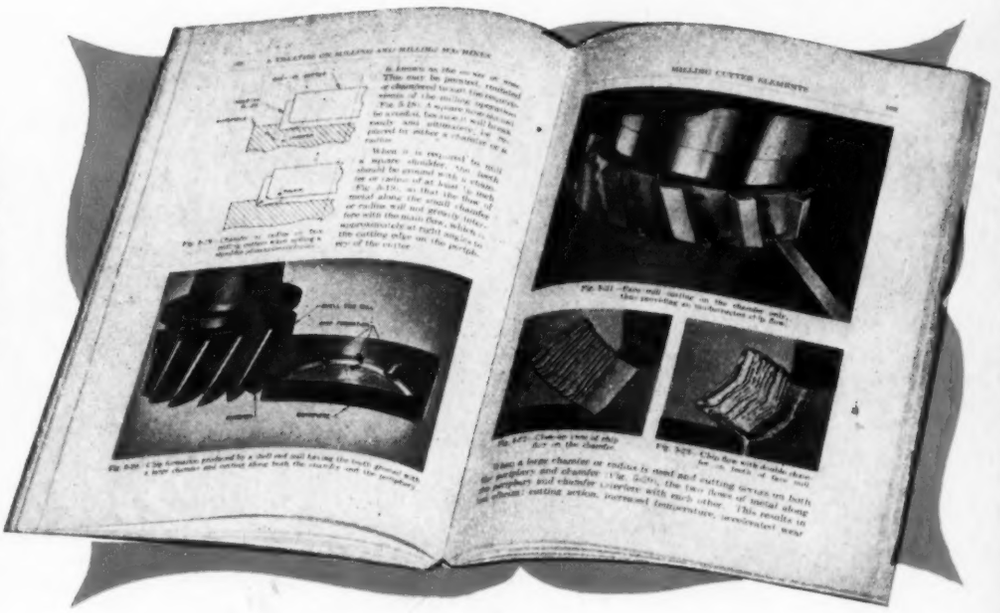
MILLING MACHINES

A New Book
ON MILLING MACHINES AND MODERN MILLING PROCEDURE

● This new book is cram full of information for those who want to keep abreast of recent developments in metal cutting by the process of milling. ¶ "Treatise on Milling and Milling Machines," Section I of a series, is devoted largely to standard milling machines, accessories and cutters. It contains 178 pages of useful data together with 176 photographs and drawings, and many tables and mathematical formulas to clarify the text and to help solve cutter problems. ¶ This new book may be used profitably by your shop supervisors... milling machine foremen, setup men, cutter sharpening foremen... and by time-study and methods engineers, tool designers, students and apprentices. Prepared by the engineers of The Cincinnati Milling Machine Co. who are backed by sixty years of milling know-how, it's devoid of advertising and written in simple, understandable language. The illustration on the opposite page shows actual size of book. Write for a copy of Section I today! The cost is only $1—postpaid anywhere. Section II of "Treatise on Milling and Milling Machines" will be published later.

●

Typical pages of Section I of "Treatise on Milling and Milling Machines." This book contains definitions of milling machines and their accessories, and detailed data on cutters, cutter materials and cutter sharpening practice.



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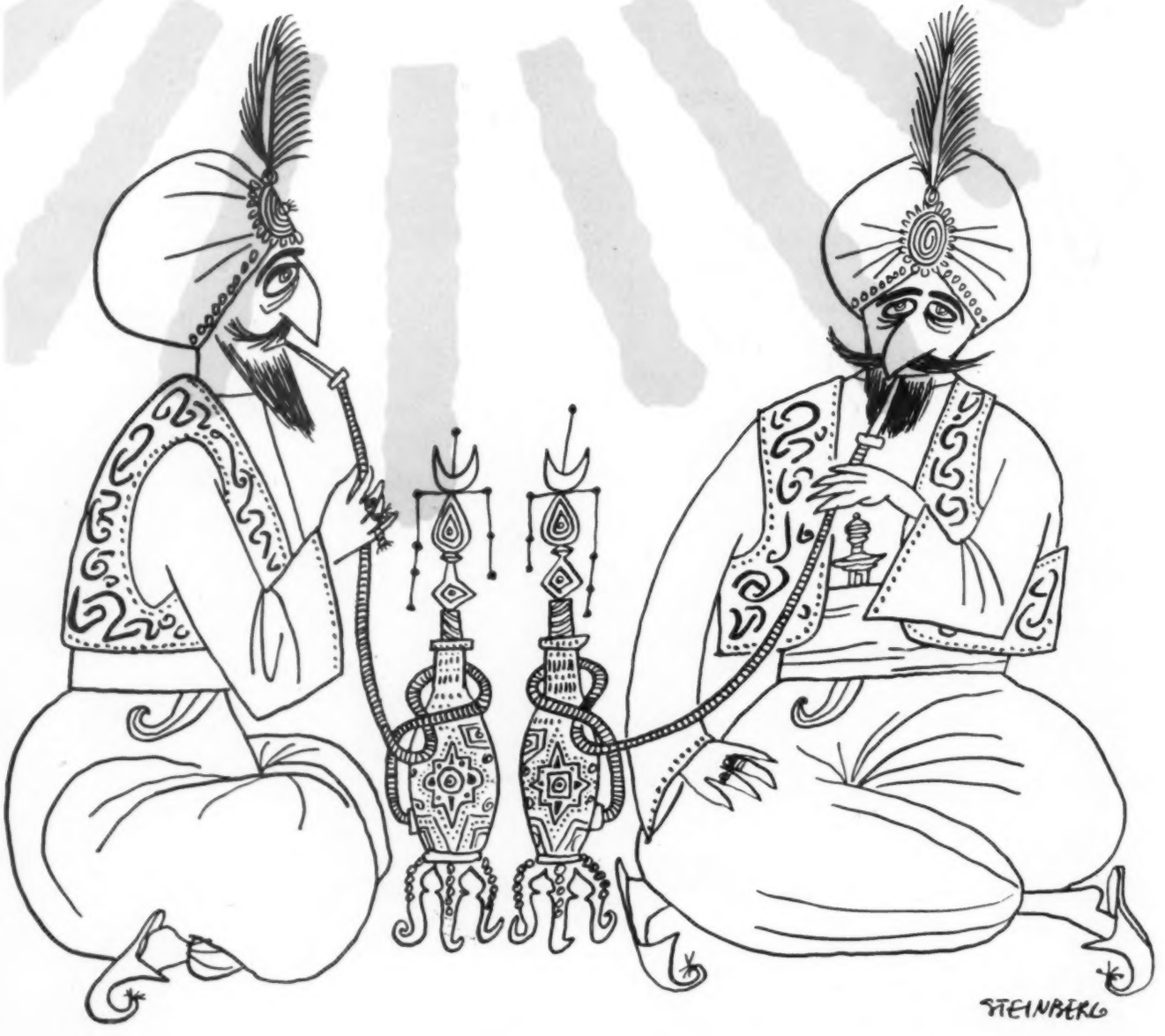
MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

no. 3

The great Horse Race Puzzle



Said an aged Caliph to his two sons: "My time has come. You each own a spirited steed, so I propose a race to Bagdad — and the son whose horse last enters the city shall inherit my estate." For weeks the two sons dawdled upon the road, each striving to go slower than the other. Then, one night at an inn, they sought the counsel of a wise man . . . and the next morning, at the crack of dawn, they lept to the saddle and rode for Bagdad as fast as the horses could run.

What did the wise man tell them?

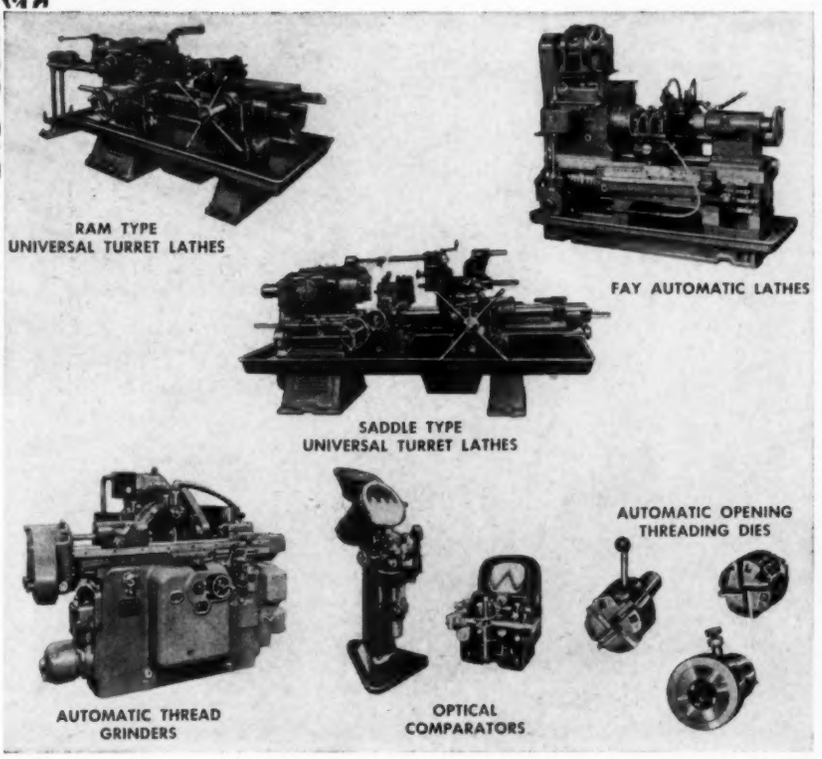
Moral: A little wisdom saves a lot of time in solving practical problems . . . and in the practical problems of metal turning, we consider ourselves to be wise.

Metal turning costs are a problem. The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

Be skeptical of the production efficiency of all metal turning equipment in your plant.

Telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.



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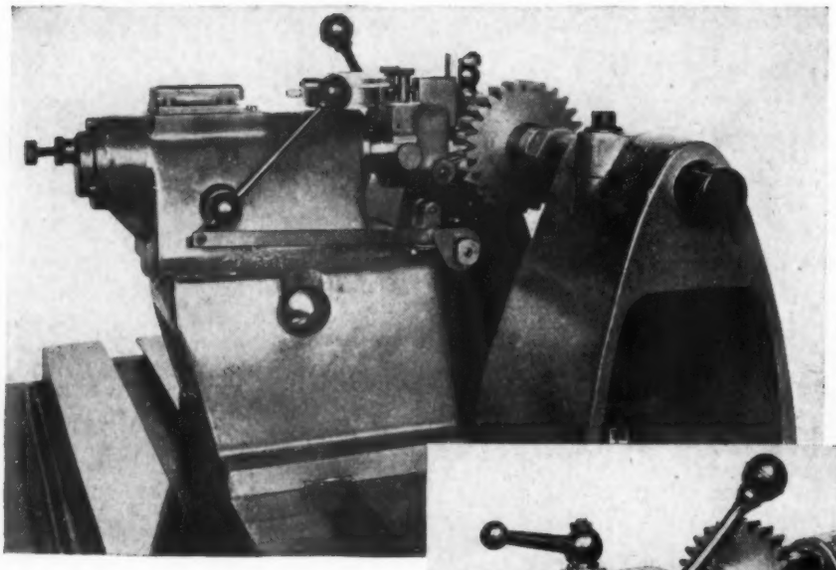
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

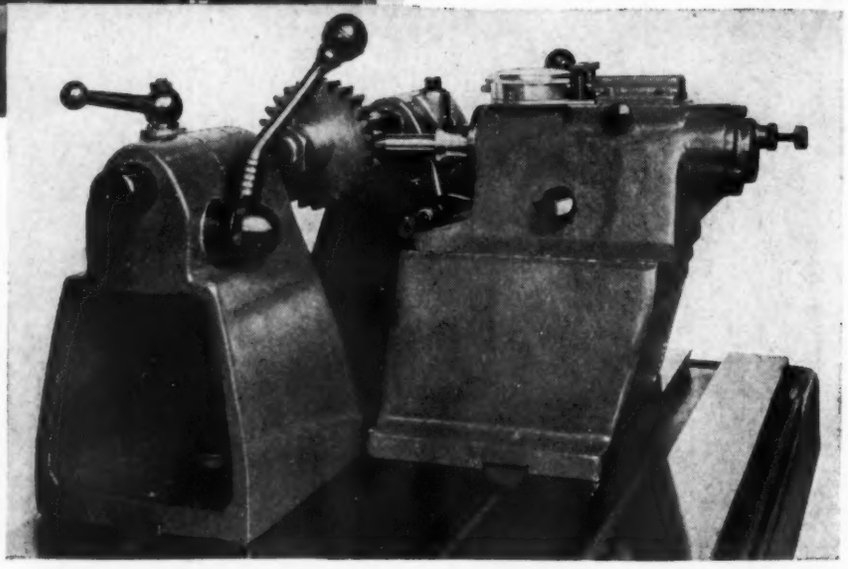
Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

Intermediate Gear Still Further



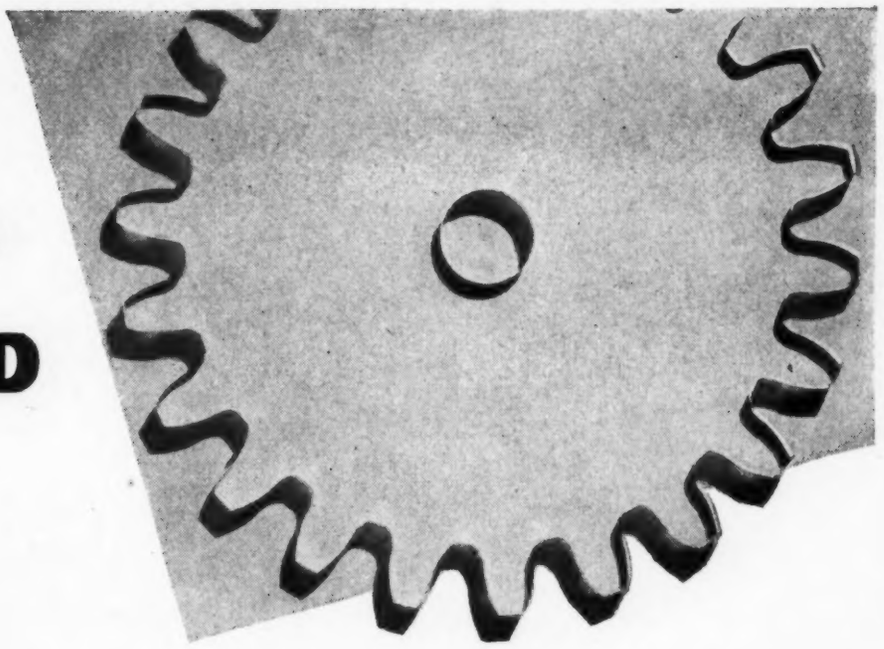
● Left: The No. 12C Inspection Instrument set-up for checking tooth spacing.

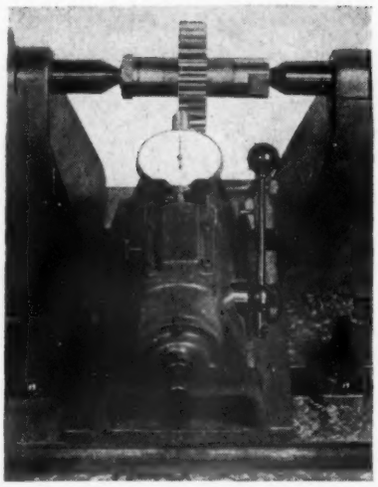
● Below: The No. 12CT Inspection Instrument showing Cone Point checking for taper of tooth.



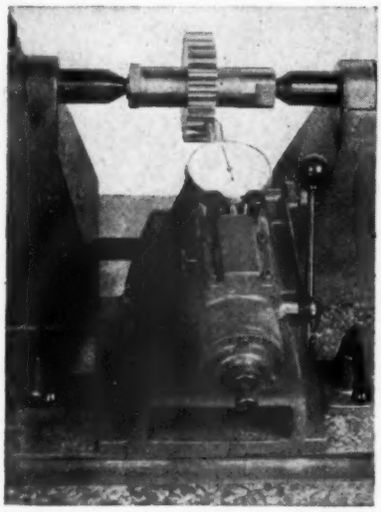
THE FELLOWS METHOD...MACHINES AND TOOLS FOR

Inspection SIMPLIFIED





Above and below: No. 12CT Inspection Instrument showing Cone Point checking for taper of tooth.



Whether used in the intermediate stage of inspection — prior to the final "Red Liner" check—or as a supplementary unit to other types of inspection equipment, the Fellows Bench-type Inspection Instrument is the logical first choice for making quick, accurate checks for concentricity, tooth spacing and taper.

To permit ease of operation and speed the change-over from one test to another, Fellows provides the device with two quickly interchangeable instrument "heads", and a dial indicator which is conveniently interchangeable with all three set-ups.

Again, both the "cone point" device for checking concentricity, and the tooth spacing device, are fitted with an automatic mechanism for indexing the gear on the return stroke of the indexing lever.

The No. 12C and No. 12CT Bench-type Inspection Instruments each have a capacity for gears up to 12" pitch diameter on mountings up to 15" long.

Ask our sales engineer to explain further the advantages that can be gained through the use of this Bench-type Inspection Instrument—or write direct for your complimentary copy of a circular describing it. The Fellows Gear Shaper Company, Springfield, Vt., or 616 Fisher Bldg., Detroit, or 640 West Town Office Bldg., Chicago.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

FEEDMATIC HOPPERS

provide continuous Flow of Parts through 7 CINCINNATI CENTERLESS GRINDERS

● The line of machines illustrated at the right might well be termed "highway to production" for the work has the green light through seven CINCINNATI Centerless Grinders. It illustrates a principle in centerless grinding procedure which offers tremendous cost reducing possibilities in high production shops. Cincinnati Application Engineers have worked out production lines of this type, one of which is illustrated. ¶ The parts are piston pins, and the operation: grind diameter to extremely close limits of accuracy and finish. Starting with the machine at the left of the line, the work passes automatically through four No. 3 and three No. 2 CINCINNATI Centerless Grinders. Each machine is served by a CINCINNATI FEEDMATIC Hopper. As the work leaves a machine, an elevating conveyor takes it to the next hopper. The entire line is completely automatic, from rough grinding at the left to ultrafinish grinding on the machine at the right. CINCINNATI FEEDMATIC Hoppers are available in two types (shown on the opposite page) and are recommended for medium to long runs. Perhaps you could use this equipment to advantage. Upon request we shall be glad to send complete details.

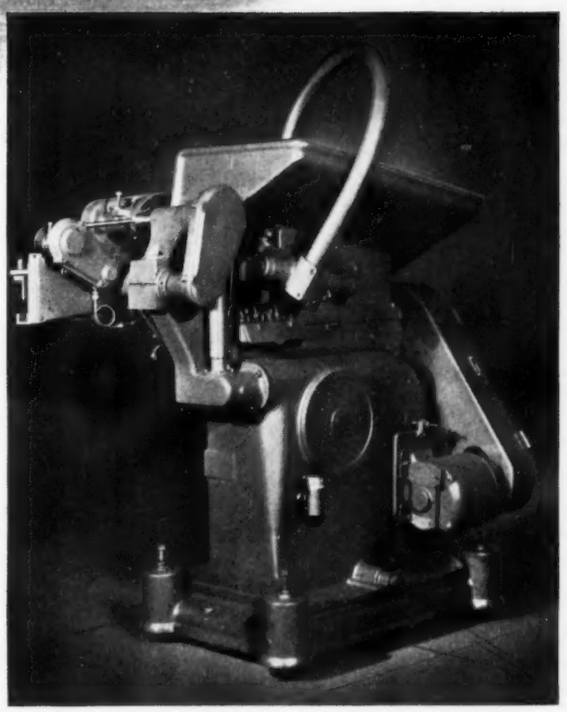
CINCINNATI

CINCINNATI No. 2 Centerless Grinding Machine. Complete specifications may be obtained by writing for Catalog G-456-4. For a brief description of all CINCINNATI Grinding Machines, look in Sweet's Catalog File for Mechanical Industries.

CINCINNATI

CENTER TYPE GRINDING MACHINES

A line of four No. 3 and three No. 2 CINCINNATI Centerless Grinders with power conveyors and CINCINNATI FEEDMATIC Hoppers, rough and finish grinding piston pins.



Above: CINCINNATI Type E FEEDMATIC Hopper for Thrufeed Grinding. This is the hopper used in the installation illustrated above. It handles all types of Thrufeed work such as piston pins, small shafts, bushings, and work of a similar nature. Powered by a ½ h.p. motor.

Left: CINCINNATI Type B FEEDMATIC Hopper for Infeed Grinding. Headed work such as studs, chain pins, valve tappets, and parts similar in shape may be automatically infeed ground by using the Type B Hopper and Automatic Infeed Attachment. Powered by a ½ h.p. motor.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

An Investment that Reduces Costs

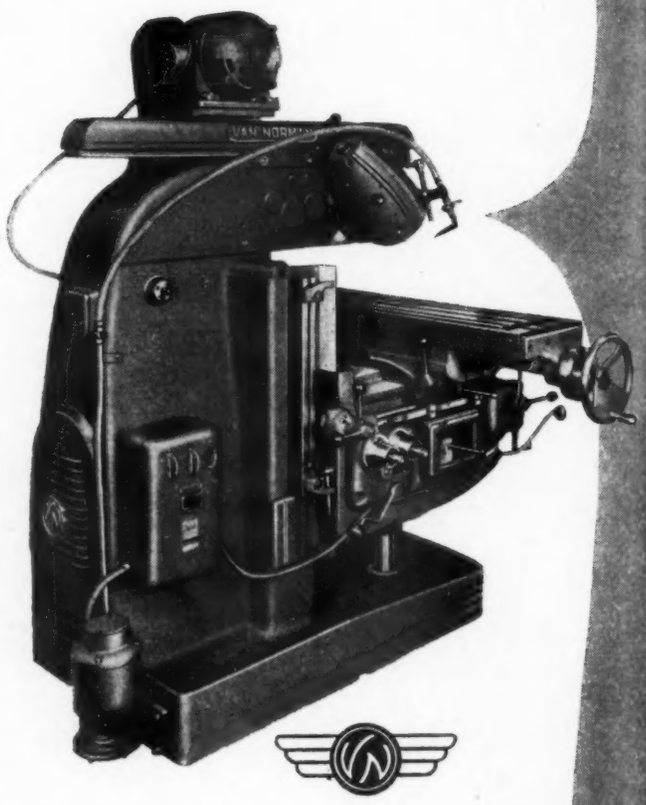
VAN NORMAN
Ram-Type Millers

No matter what your milling requirements . . . horizontal, angular, vertical . . . you can do the job on a *single* Van Norman Ram Type miller. How—simply swivel the adjustable cutterhead to the desired cutting position and you're ready for the operation.

The versatility of ram type millers to perform the work of many single-purpose machines pays off dividends by cutting idle machine and operator time as much as 50% because there is no waiting for specific machines . . . no continual changing of the workpiece. And in those plants where milling operations change from period to period, Van Norman Ram Type millers change to meet the work by swiveling the adjustable cutterhead. All horizontal, angular or vertical . . . some horizontal, some vertical, etc.—those are the combinations you can have with Van Norman Ram Types.

For ease of operation and accuracy of work, Van Norman gives you front and rear control of all power and manual feeds, single-lever feed selector, finger-tip directional control of power feeds, large easy-to-read dials, movable ram . . . each and every feature points to increased production, lower milling costs, wide application of use.

Find out how you can profit with Van Norman Ram Type millers. Write for information, today. They are available in 8 standard models with plain or swiveling tables.



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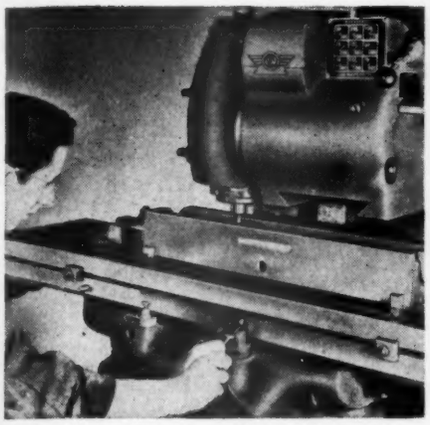
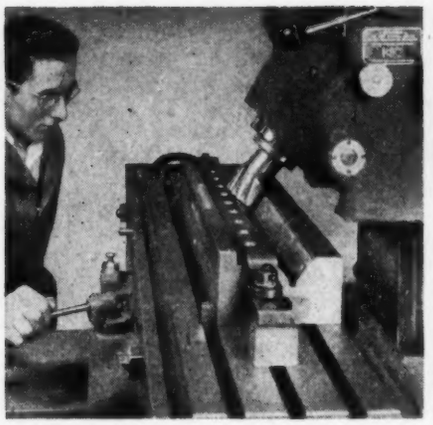
SPRINGFIELD 7, MASSACHUSETTS

"It Pays to Van Normanize"

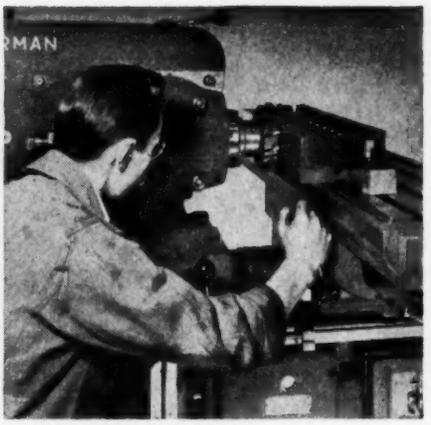
Cuts work reset-ups...improves accuracy



VERTICAL MILLING—With the adjustable cutterhead locked vertical and the workpiece positioned, the operator, using the front controls, starts the operation by milling a recess in the work.

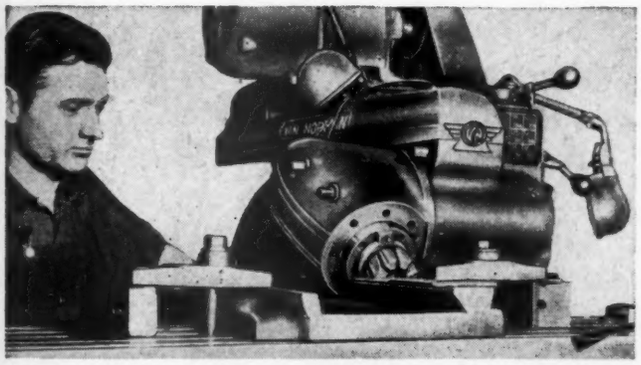


ANGULAR MILLING—Here a "V" is being milled. Note that only the position of the cutterhead has been changed, the workpiece is still in the original position.

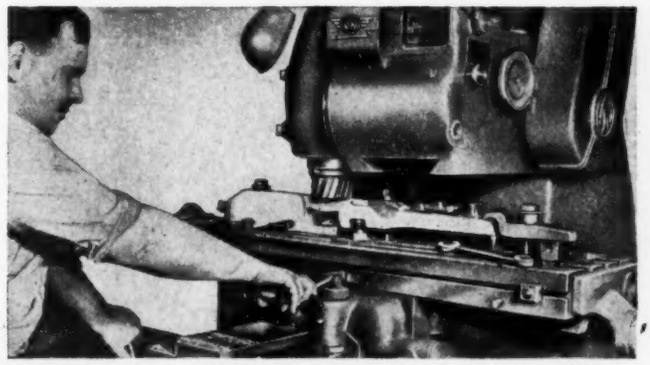


HORIZONTAL MILLING—Using the rear controls the operator completes the job with a face milling operation. One work set-up and simple changes in the versatile cutterhead complete most jobs.

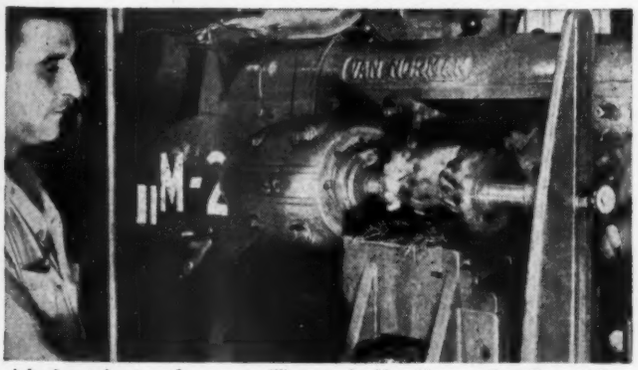
Eliminates idle machine time...increases production



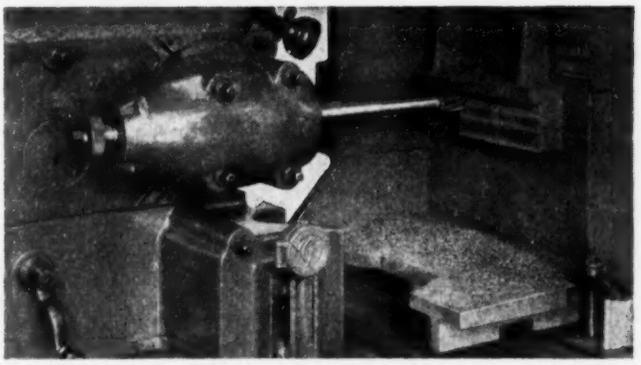
With the head locked in an angular position, the operator is taking an angular cut operating the miller with rear *directional* controls.



The Ram Type Miller used with the adjustable cutterhead in vertical milling position and operator using front *directional* controls.

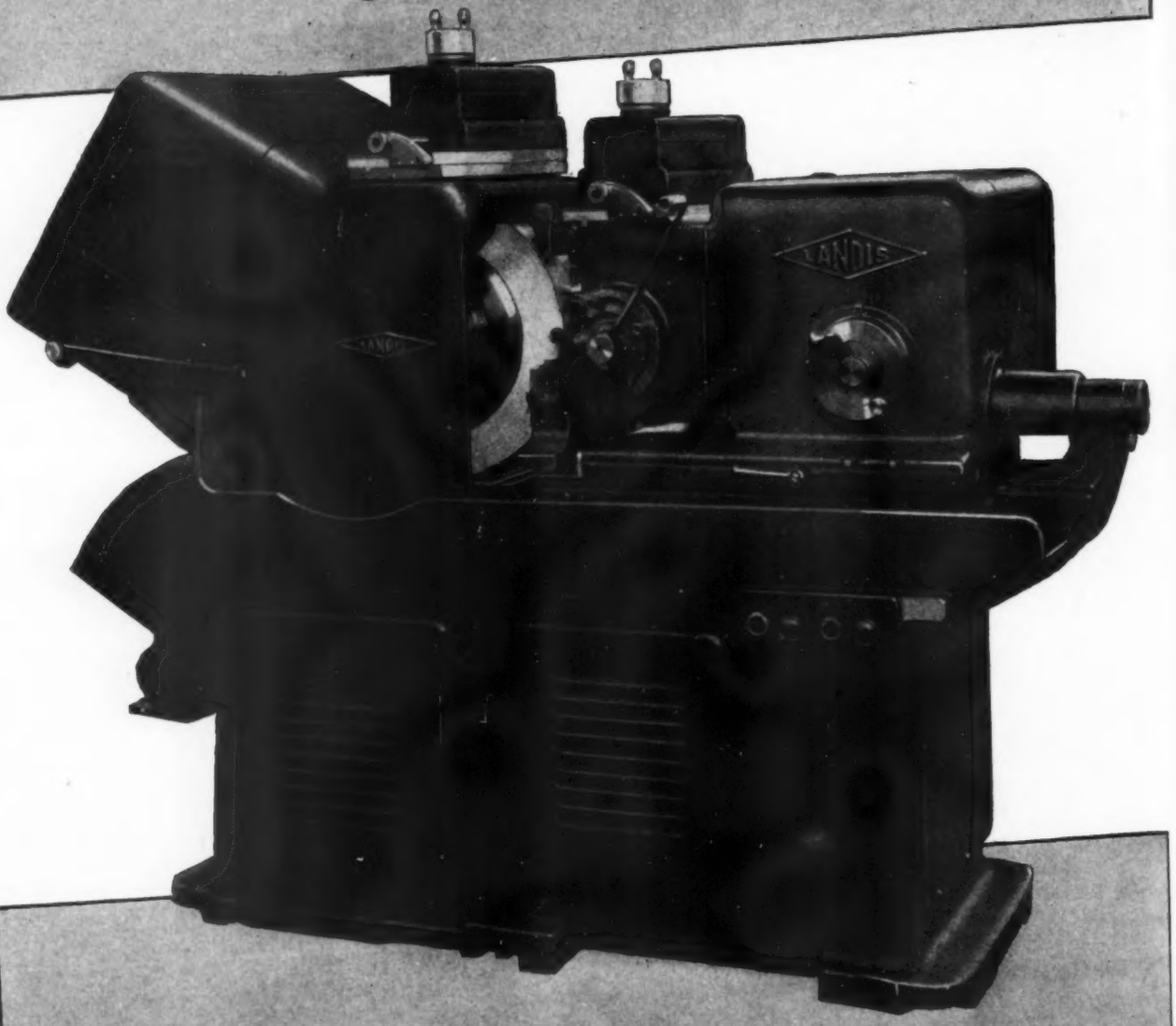


A horizontal set-up for gang milling on the Van Norman Ram Type Miller. The ram type overarm with dovetail ways and arbor support assure rigidity and accuracy.



Horizontal milling of a heavy workpiece. The heavy-duty column, knee, saddle and table assemblies assure accuracy of all types of cuts and workpieces.

The CENTERLESS



LANDIS
REG. U.S. TRADE — MARK PAT. OFF.

LANDIS

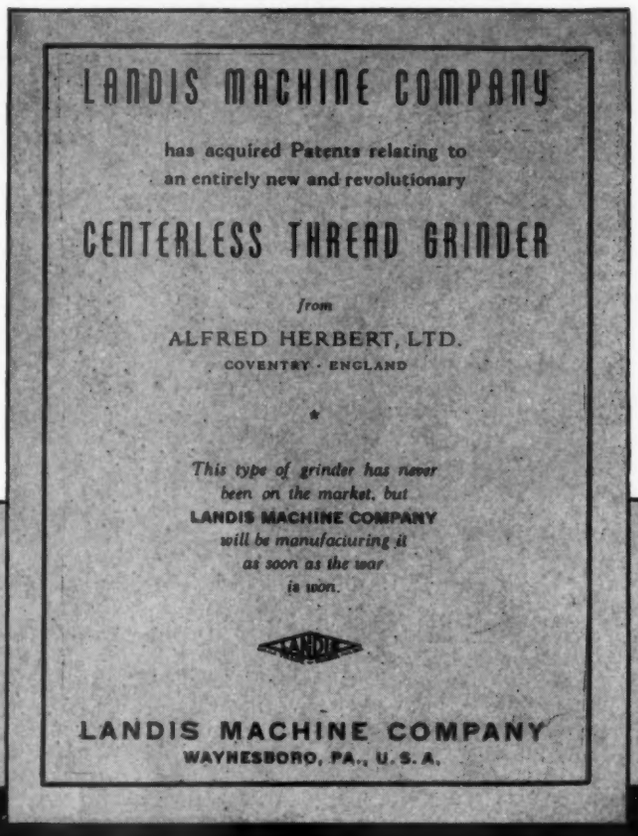
THREAD GRINDER

Announced by

LANDIS MACHINE CO. in 1944 . . .

is NOW AVAILABLE

Reproduction of Advertisements Appearing in Trade Magazines, January, 1944



A most desirable feature of the LANDIS Machine Company's Centerless Thread Grinder is the ability to thru-feed headless parts or plunge-cut headed work. This feature gives the machine a much wider field of application.

Write for Particulars

MACHINE CO. WAYNESBORO PA. U. S. A.

Adds Years of SERVICE...

Yes, the patented double low-hung spindle drive adds years of effective service to "AMERICAN" Hole Wizard Radial Drills—and in addition insures smooth holes and more holes per drill grind

This patented spindle construction provides two drives—one through a large helical gear for the low-speed range and one through a smaller gear for the high-speed range This division of service between one large diameter and one smaller diameter gear results in low gear tooth pressures when performing large diameter drilling and boring operations through the low-speed range and low gear velocities when drilling at high speeds through the high-speed range. This is an ideal drive and unmistakably adds up to a longer and more effective life for the spindle transmission.

However, this is only part of the story. This drive is located at the bottom of the head as close as possible to the work, definitely reducing the torsional stress on the spindle, thus imparting a smooth action to it which in turn results in smooth, high quality work and prolongs the cutting edges of the tool.

The spindle itself is made of NITRALLOY steel as is also the spindle sleeve and both are nitrided for extreme surface hardness, the spindle being ground and the sleeve honed to very close limits. The spindle and sleeve are Timken mounted with an adjustment for wear. This construction, combined with thorough lubrication by filtered oil, insures long life, maintained accuracy and low maintenance.

Cost-minded officials select "AMERICAN" Radials.

Will gladly send literature

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U.S.A.

Lathes and Radial Drills

BALANCED CONSTRUCTION

Makes TEXROPE V-BELTS Run Cooler... Smoother...Longer

Look at this cross-section of a TEXROPE Super-7 V-Belt. This balance between rubber, cord and fabric — the weight of cover — position of load carrying cords — thickness of cushion — width and depth of belt — have been carefully engineered. They've been proved on the machines of American industry through 20 years of successful operation.

This long experience has developed other advantages, too: *50% Stronger Cords,* of long staple hard-twisted cotton — *Tough Duplex Cover* to take the wear, seal out dirt and grit — *Thick Cushion* of cool-running improved Buna-S to protect the cord structure from shock.

YOUR V-BELT DRIVE HEADQUARTERS

Call your Allis-Chalmers office or dealer for TEXROPE Super-7 V-Belts — for full range of standard, "Magic-Grip" and Vari-Pitch sheaves — for Speed Changers and complete V-Belt Drive engineering help. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 2034

HEAR THE BOSTON "POPS":
Every Saturday Evening, American Broadcasting Co.

WHICH TEXROPE Super-7 DO YOU NEED?

Pick the right TEXROPE Super-7 V-Belt — it'll give you the most in efficient power transmission and economy.

TEXROPE Super-7 V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by A-C.

Heat-Resisting Super-7
Stands temperatures up to 180°. The TEXROPE V-Belt for most drives.

Oil-Resisting Super-7
Neoprene cover protects core against moderately oily or greasy conditions.

Oil-Proof Super-7
Made of Neoprene throughout. Use it when the belt must swim in oil.

Static-Resisting Super-7
Recommended where explosion hazard exists. Static-conducting element throughout cover won't wear off.

Super-7 Steel
Twin steel cables, to pull extremely heavy loads with minimum stretch.

GET THEM — through your Allis-Chalmers district office or dealer.

ALLIS CHALMERS TEXROPE V-BELT DRIVES

A MIRROR FINISH

Ground to surface finish of under 1 micro inch

• The mirror finish of under a micro inch produced on this roll is typical of the fine finishes that can be produced on standard Landis Tool Hydraulic Universal Grinders.

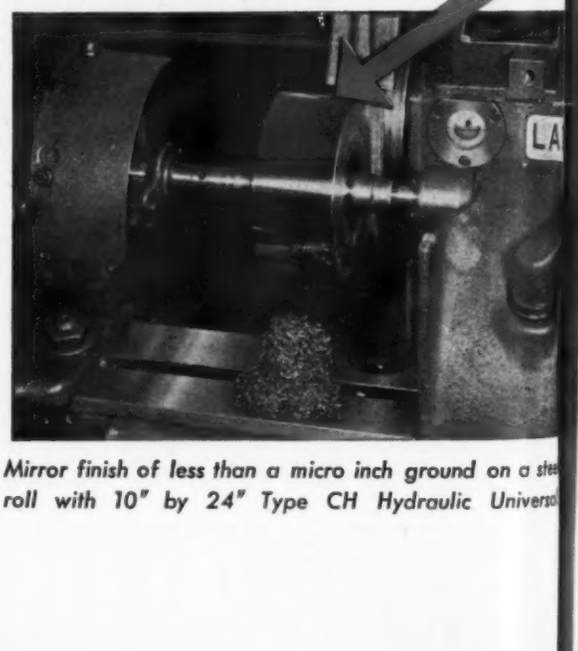
The results come from a combination of design features, many of them exclusive, plus craftsmanship of the highest order in manufacture and assembly. Finally all machines are given full operating tests before shipment. Here are what some of the exclusive Landis Tool features mean in grinding results: Double cylinder hydraulic table traverse assures smooth traverse and reversal; microsphere wheel spindle bearings require less than usual clearance and can be compensated for wear; dynamic balance of rotating parts assures freedom from vibration; variable voltage headstock drive gives stepless speed adjustment from 55 to 495 rpm.

The universal features of this grinder make it ideal for tool room work. The hydraulic features speed production because the hydraulic automatic wheel feed and hydraulic table traverse can be adjusted readily to the combination best suited to the job.

For detailed information on the 10" x 24" type CH Hydraulic Universal Grinder ask for Landis Tool Catalog I45.

EXCLUSIVE LANDIS TOOL DESIGN FEATURES CONTRIBUTE TO ACCURACY AND FINE FINISH!

- **Variable Voltage Headstock Drive**
- **Microsphere Wheel Spindle Bearings**
- **Double Cylinder Hydraulic Table Traverse**
- **Dynamically Balanced Rotating Parts**



Mirror finish of less than a micro inch ground on a steel roll with 10" by 24" Type CH Hydraulic Universal

LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY

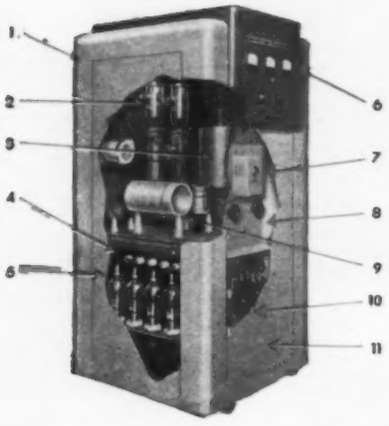
Smoother than Glass

10" x 24" TYPE CH HYDRAULIC UNIVERSAL GRINDER—Fully universal headstock. Swiveling wheelbase. Standard equipment includes: ball bearing type internal fixture; chuck for internal and face grinding; automatic hydraulic wheel feed.

LANDIS TOOL *Company*

WAYNESBORO, PENNA.

16 mm. Color-Sound Movie Explains Induction Heating!



THESE FEATURES OF ALLIS-CHALMERS NEW INDUCTION HEATER OFFER A WIDE RANGE OF APPLICATION TO INDUSTRY

1 What's your heating problem? Brazing? Hardening? Soldering? Annealing? Melting? Heating for Forging? This new productive unit handles them all!

2 Sturdy, long-life Oscillator Tubes are fully protected against overloads.

3 New Coupling System developed by A-C keeps losses low and improves the output efficiency

4 Complete 3-Phase Power System with over 90% power factor.

5 Transformer is designed for heavy-duty 'round the clock production. Has large reserve capacity.

6 Large, easily read instruments show when power is on, also indicate grid and plate currents including filament voltage.

7 Automatic Timer controls heat sequence in split seconds from 2 seconds to 20 minutes . . . makes unit easy for unskilled operators to use. Also gives high product uniformity and reduces rejects.

8 All controls are on one panel . . . protected from tampering by door and lock.

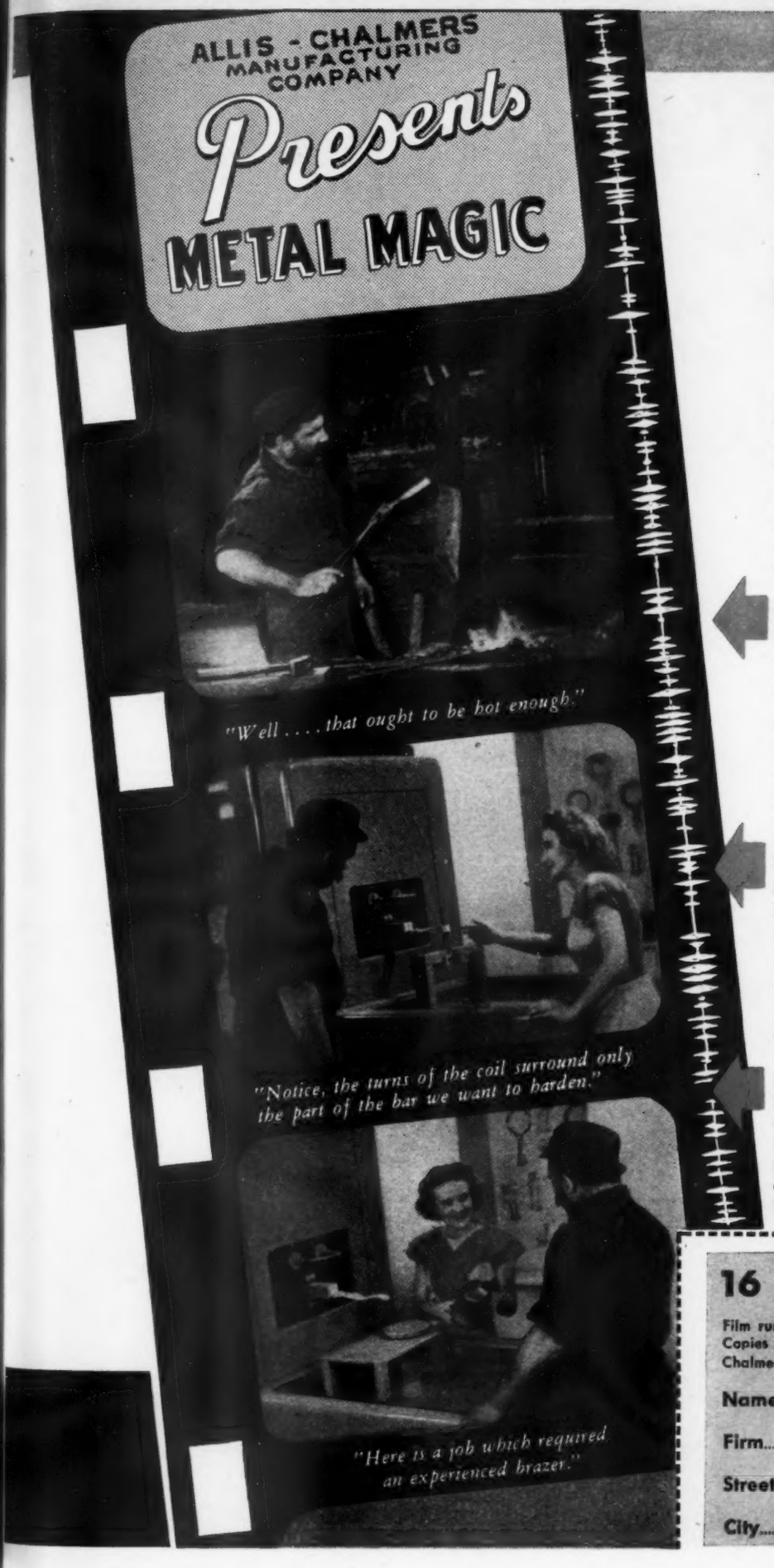
9 Specially designed Choke Coil protects rectifier tubes from damage by high frequency radio currents.

10 Safety Features: Heavy-duty control; high water-temperature switch; fuses; interlocking switches on doors protect operators.

11 Attractive, Compact Steel Cabinet mounted on heavy-duty casters encloses unit. Provides shielding.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products


ALLIS - CHALMERS MANUFACTURING COMPANY
Presents
METAL MAGIC
"Well . . . . that ought to be hot enough."
"Notice, the turns of the coil surround only the part of the bar we want to harden."
"Here is a job which required an experienced brazer."

NOW AVAILABLE, NEW FILM TELLS STORY OF THE APPLICATION OF INDUCTION HEATING TO INDUSTRY

Is the induction heater a *practical* production tool? Will it improve products, reduce costs, increase production? These are just a few of the questions Industry is asking today. Allis-Chalmers new movie, "Metal Magic", answers many of these questions for you. It also tells of man's attempts to harden metals . . . from the time of the old village blacksmith until today.

Here, the old blacksmith has slowly heated a bar of metal to the temperature he *thinks* will allow proper hardening. In direct contrast, Induction Heating eliminates guesswork completely because both *amount* and *penetration* of heat can be controlled for each successive operation.

The outstanding feature of Induction Heating is *selectivity*. With a work coil of proper design, heat can be applied to a *pre-selected area,* leaving the balance of the part comparatively cool. Selective heating practically eliminates distortion, making expensive straightening operations unnecessary . . . another step in reducing production costs.

Induction brazing has many advantages, foremost of which is the amazing reduction in heating time. Operations which formerly took *minutes* can often be induction-brazed in as many *seconds*. And since heating time is so fast, oxidation is reduced and little or no objectionable scale is formed. For a free showing of this entertaining and instructive film, fill in the coupon below, now. (NOTE: This offer limited to U.S.A. only.) A 2053

16 MM. PRINTS FREE

Film runs 12½ minutes on 16 mm sound projectors. Copies now available for loan. Mail coupon to Allis-Chalmers, Dept. "B", Milwaukee 1, Wis.

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Firm.....

Street.....

City.....**State**.....

The NORTON 4" Type C . . .

A PRECISION MACHINE

Designed for Grinding Small Work . . .

- Electronically-controlled variable work speed drive over a wide range.
- Compact controls and adjustments conveniently located for maximum operating convenience.
- Time-wasting hand motions eliminated by interrelated automatic controls.
- Hydraulic table traverse — hydraulic power rapid traverse of wheel slide — two-speed hand table traverse — grinding wheel reciprocation.

The Norton 4" Type is a grinder that can turn out small cylindrical work to extremely high accuracy standards at an extremely high production rate. A new catalog — Form 287 — gives complete details.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

M-319

NORTON GRINDERS
and Lappers

UNION

"The Tools you Buy Again"

ARE THE TOOLS THAT ASSURE BETTER, FASTER WORK AT LOWER COST

Longer lasting accuracy and greater all-round efficiency of UNION tools under stepped-up production demands are the direct result of careful selection of materials, close production control through every step in manufacture and developments in tool design which only long, specialized experience can create.

Better, faster work at lower cost should be the determining factor in selecting those small tools which play such a big part in today's production. Because such results are consistently attained with UNION TOOLS, the wisdom of specifying "UNION" is apparent.

The UNION LINE

TWIST DRILLS
MILLING CUTTERS
REAMERS
HOBS
SLITTING SAWS
END MILLS
TAPS
DIES
SCREW PLATES
PROFILE CUTTERS

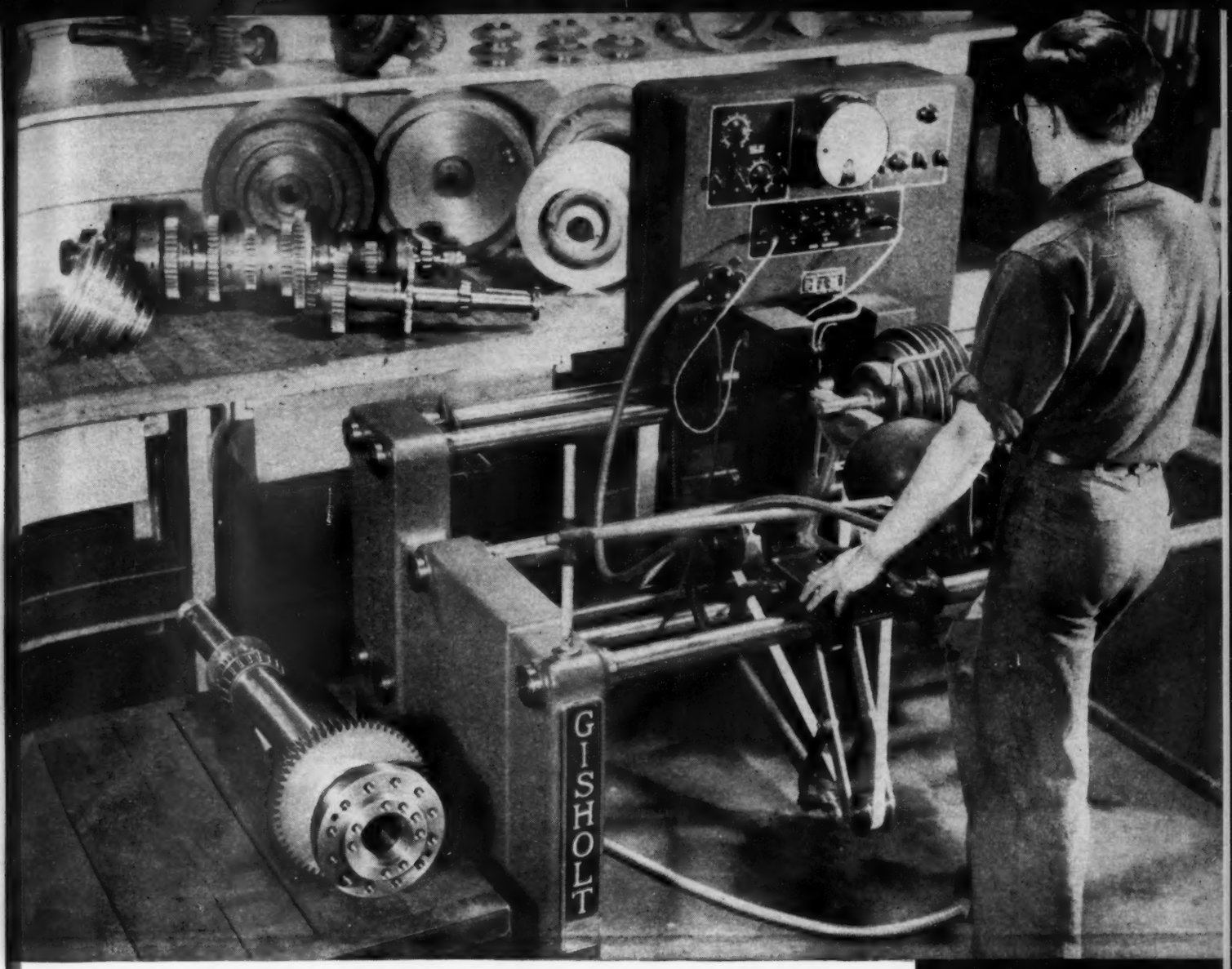
UNION TWIST DRILL CO., Athol, MASS.

STORES—New York: 61 Reade St., Chicago: 11 So. Clinton St., Detroit: 5527 Woodward Ave., San Francisco: 121 Second St., Los Angeles: 524 E. Fourth St., Seattle: 568 First Ave., South.

MANUFACTURING DIVISIONS

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec.

UNION



HOW EASY TO APPLY

Dynetric Balance

TO A WIDE VARIETY OF PARTS!

Look at this variety of parts—all sizes and shapes—and all in the day's work for a Gisholt Dynetric Balancing Machine*. One minute it's spotting the unbalance in a machine tool spindle . . . now, with a quick adjustment, it's pointing out corrections for a drive pulley. Bearings, clutch parts, gears—Gisholt Dynetrics take them all in stride! A simple dial reading tells the story, as unbalance vibrations down to .000025" are *located, measured,* and *readied for correction.*

Take no chances with destructive vibration! Gisholt makes it easy and economical to balance any rotating assembly from a fraction of an ounce to many tons. Write for complete information!

**Developed jointly with Westinghouse Electric Corporation*

GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison 3, Wisconsin

TURRET LATHES
•
AUTOMATIC LATHES
•
SUPERFINISHERS
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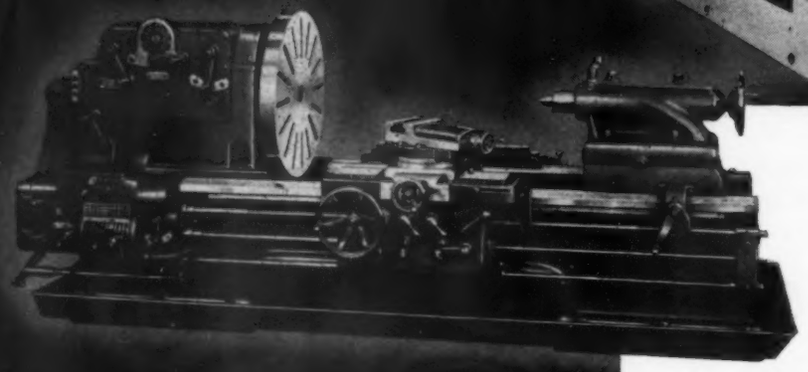
BALANCERS
•
SPECIAL MACHINES

GISHOLT

Look Ahead . . .
Keep Ahead . . .
with Gisho



Builders of Precision Machinery
THE SIDNEY MACHINE TOOL COMPANY
SIDNEY • OHIO
SIDNEY
ESTABLISHED 1904

Rigid Bed Construction

This modern bed cast of semi-steel, nickel mixture provides close grained, hard bearing surfaces for Carriage ways. Beds having three vees assure greater rigidity to Carriage and Tailstock for heavy straight or taper turning. The three vees and flat present a greater bearing surface and provide more support to Carriage bridge. Note that the massive bed is provided with longitudinal girt reinforced by two-wall cross girts at 24" intervals assuring accuracy under heaviest service in resisting deflections and torsional strains.

Bulletins on all sizes available.

IDENTIFIED with American Industry...

Ex-Cell-O's A Different Industrial Magazine

XLO
EX-CELL-O for PRECISION

Tool Tips, published regularly by Ex-Cell-O since 1925, is "devoted to minimizing the cost of production". Every issue contains a variety of useful hints to help you produce more accurate parts at lower unit cost.

Tool Tips is a free and an invaluable source of information to all who are interested in recent developments in metal working. If you are not now receiving *Tool Tips*, write Ex-Cell-O on your company letterhead today.

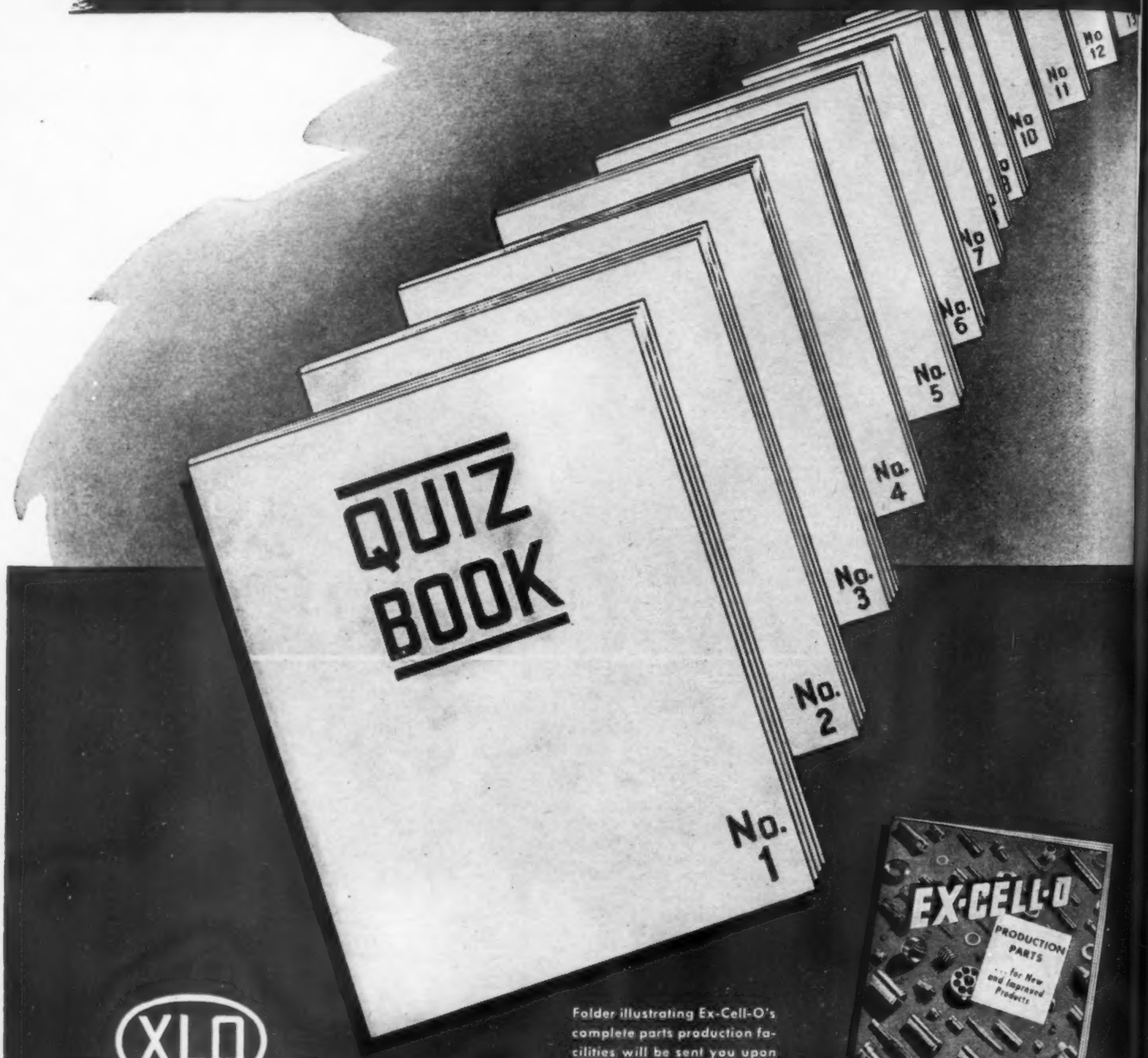
46—49

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

EX-CELL-O *makes*

- Standard and Special Multiple Way-Type Precision Boring Machines
- Multiple Drilling and other Special Purpose Machines
- Precision Thread Grinding Machines
- Precision Lapping Machines
- Broaches and Broach Sharpening Machines
- Continental Cutting Tools
- Tool Grinders
- Hydraulic Power Units
- Grinding Spindles
- Drill Jig Bushings
- Drill Chip Breakers
- Inspection Fixtures
- Fuel Injection Equipment
- R. R. Pins and Bushings
- Pure-Pak Paper Milk Bottle Machines
- Aircraft and Miscellaneous Production Parts

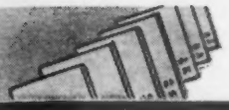
WE DON'T KNOW ALL



XLO
EX-CELL-O for PRECISION

Folder illustrating Ex-Cell-O's complete parts production facilities will be sent you upon request. Write or wire Ex-Cell-O today and ask for Ex-Cell-O Bulletin No. 36151.

EX-CELL-O CORPORATION



THE ANSWERS...

BUT IF YOUR PROBLEM IS ONE OF ACCURATELY-MACHINED METAL PARTS ON A PRODUCTION BASIS, EX-CELL-O HAS THE SOLUTION

With experienced engineers . . . modern plants . . . complete production facilities . . . Ex-Cell-O is ready to supply accurate metal parts on a production basis. In the Ex-Cell-O organization, you have the benefit of many years of accumulated knowledge in production engineering . . . plus modern and complete machining, heat-treating, grinding, assembling, and inspection processes . . . and the practical "know-how" in making our own precision cutting tools for many years . . . all under one management. For accurately made parts or sub-assemblies at a minimum cost, write Ex-Cell-O today, or contact any of Ex-Cell-O's field representatives in leading industrial centers in the United States and Canada.

LEFT . . .
Single spindle automatic screw machines on which small and medium size individual parts receive primary machining in the production schedule.

RIGHT . . .
One of many production lines at Ex-Cell-O where sequence of operations is efficiently engineered for fast and low-cost production.

DETROIT 6, MICH.

EX-CELL-O's Precision Production Parts *facilities:*

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Engine Lathes
Centerless O.D. Grinders
Centerless I.D. Grinders
Single and Multiple Spindle Drilling Equipment
Form Grinding Machines
Plain O.D. Grinders
Plain I.D. Grinders
Surface Grinders (Plain and Rotary)
Milling Machines
Thread Milling Machines
Broaching Machines (Vertical and Horizontal)
Precision Thread Grinders
Thread Rolling Machines
Precision Boring Machines
Lapping Machines
Special High Production Equipment

HEAT TREAT

Induction Heat Treating
Laboratory for Heat Treat Control including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

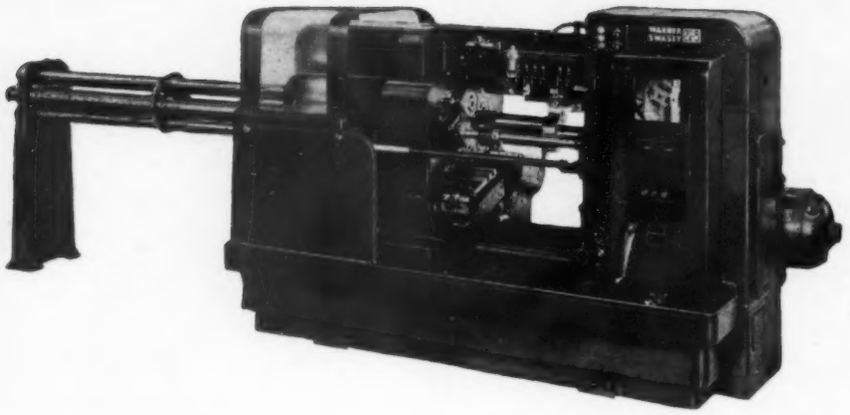
UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accident; that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the machining process.

48—96



Warner & Swasey Multiple Spindle Automatics

Now "automatic production" can be profitably applied to short and medium runs. New Warner & Swasey Bar and Chucking Automatics have the patented Quick-Set mechanism that eliminates cam changes and saves time in changing set-ups for different jobs so that small lots, as well as medium and long runs, are practical and profitable.

2 MODELS

5-Spindle Bar Machine, 1¾" Bar Capacity. (Can be furnished on order with oversize spindles to handle light work up to 2¼".) 5-Spindle Chucking Machine, 6" Swing.

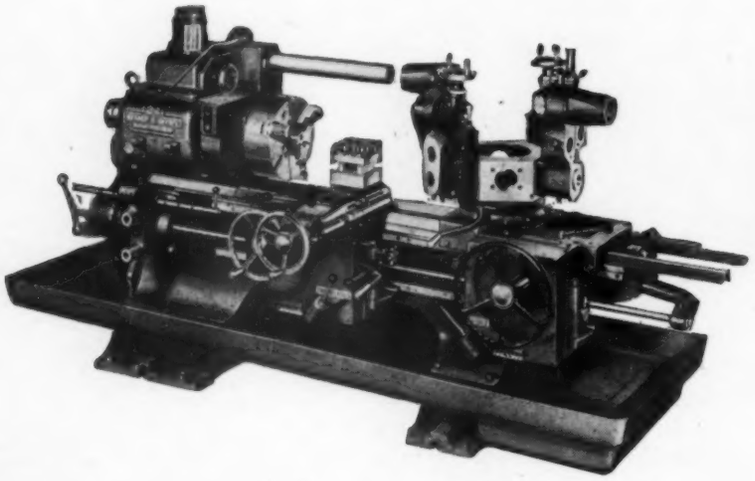
It takes less time to make

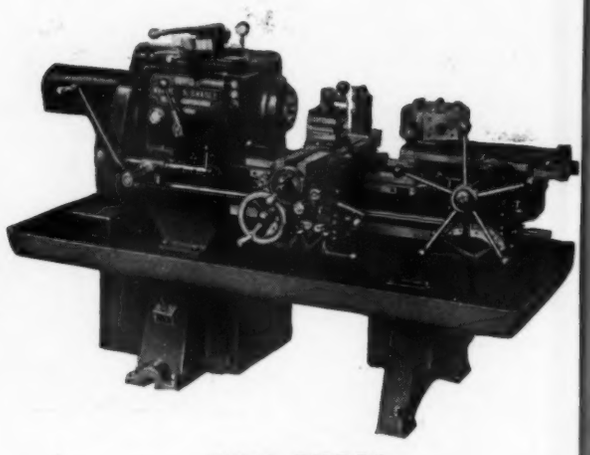
Warner & Swasey Ram and Saddle Type Turret Lathes

New Warner & Swasey Turret Lathes have many time-saving design improvements to bring you increased production at lower cost. They have greater power for taking heavier cuts under multiple tooling set-ups, at higher speeds, reducing floor to floor time. Their rigidity holds extreme precision on large chucking operations as well as on small parts to minimize scrap loss. Ease of handling decreases operator fatigue, making possible continuous high levels of output.

SADDLE TYPES

4 models, with bar capacities from 2½" to 12", swings from 16¼" to 28¼".

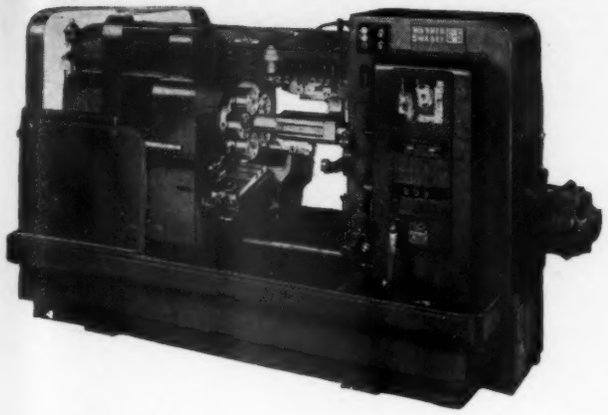




RAM TYPES

6 models, with bar capacities from 9/16" to 2½", swings from 11" to 20".

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS...



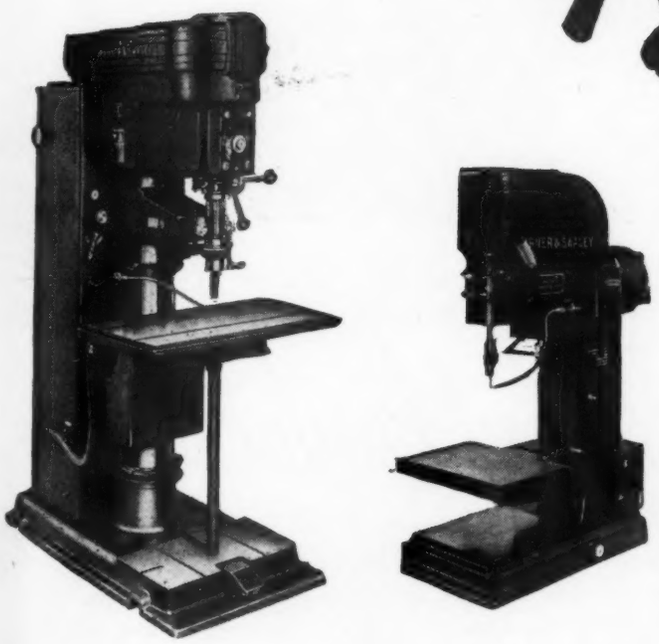
more money!

★ Why is it so difficult to maintain adequate margins of profit these days? No profound economic study is necessary to answer *that* question. It's simply that labor and material costs have risen, while in most instances rates of production have not.

Stepped-up production is the one solution to the problem—more goods completed at the end of each day—a working day often of fewer hours than formerly. Perhaps it can be done by speeding up manual effort. The sounder solution however is in giving workers better tools and machines so more work can be produced easier—in less time.

The new, improved machine tools built by Warner & Swasey provide ways to produce faster, more accurately and economically.

We sincerely believe we can help cut production time in your plant, either through new Warner & Swasey machine tools, or by suggesting new accessories for your present machines to increase their volume. Your nearest Warner & Swasey field office will be glad to discuss the subject with you; or write direct to Warner & Swasey, Cleveland 3, Ohio.



4 MODELS

No. 10 (Bench Model)—Capacity No. 0-80 to 10-24

No. 11—Capacity No. 8-36 to 7/8"

No. 11R Radial—Capacity No. 8-36 to 7/8"

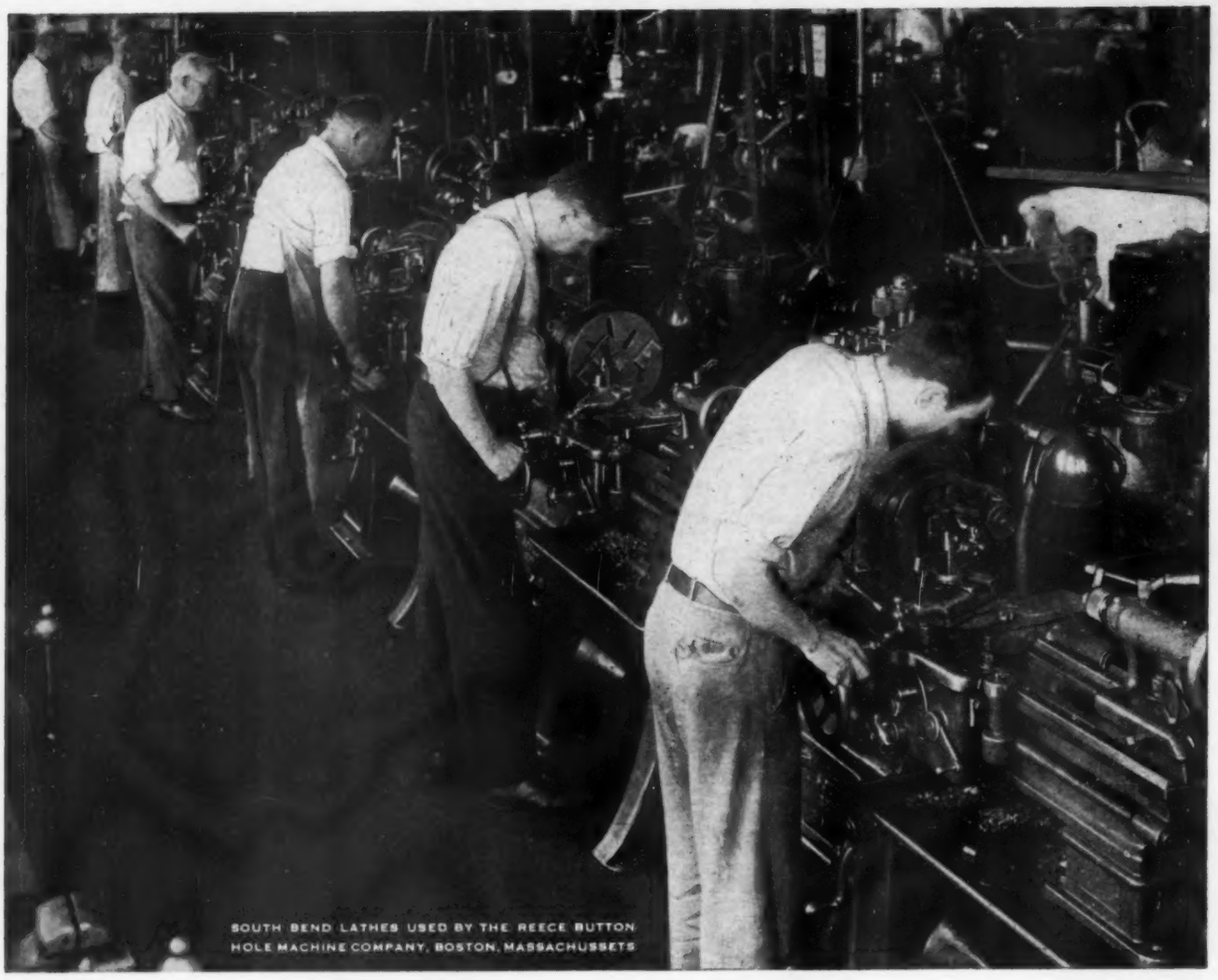
No. 12—Capacity 3/8" to 2½"

Warner & Swasey Precision Tapping and Threading Machines

The new and radically different leading-on principle of Warner & Swasey Precision Tapping and Threading Machines insures faster production of class 3, 4 and 5 gage fits. Reduces tap breakage. Practically eliminates scrapping of pieces due to thread errors. Perhaps the increased productivity and ease of operation of these new Warner & Swaseys would make them a good investment for your shop.

WARNER & SWASEY
Machine Tools
Cleveland

WITH A WARNER & SWASEY • **TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES**



SOUTH BEND LATHES USED BY THE REECE BUTTON HOLE MACHINE COMPANY, BOSTON, MASSACHUSSETS

SOUTH BEND LATHES

Speed the Flow of Production

BROADEN SCOPE OF LATHES

A complete line of South Bend attachments and accessories further increases the versatility and productiveness of South Bend Lathes. Write for illustrated Accessory Catalog 77.

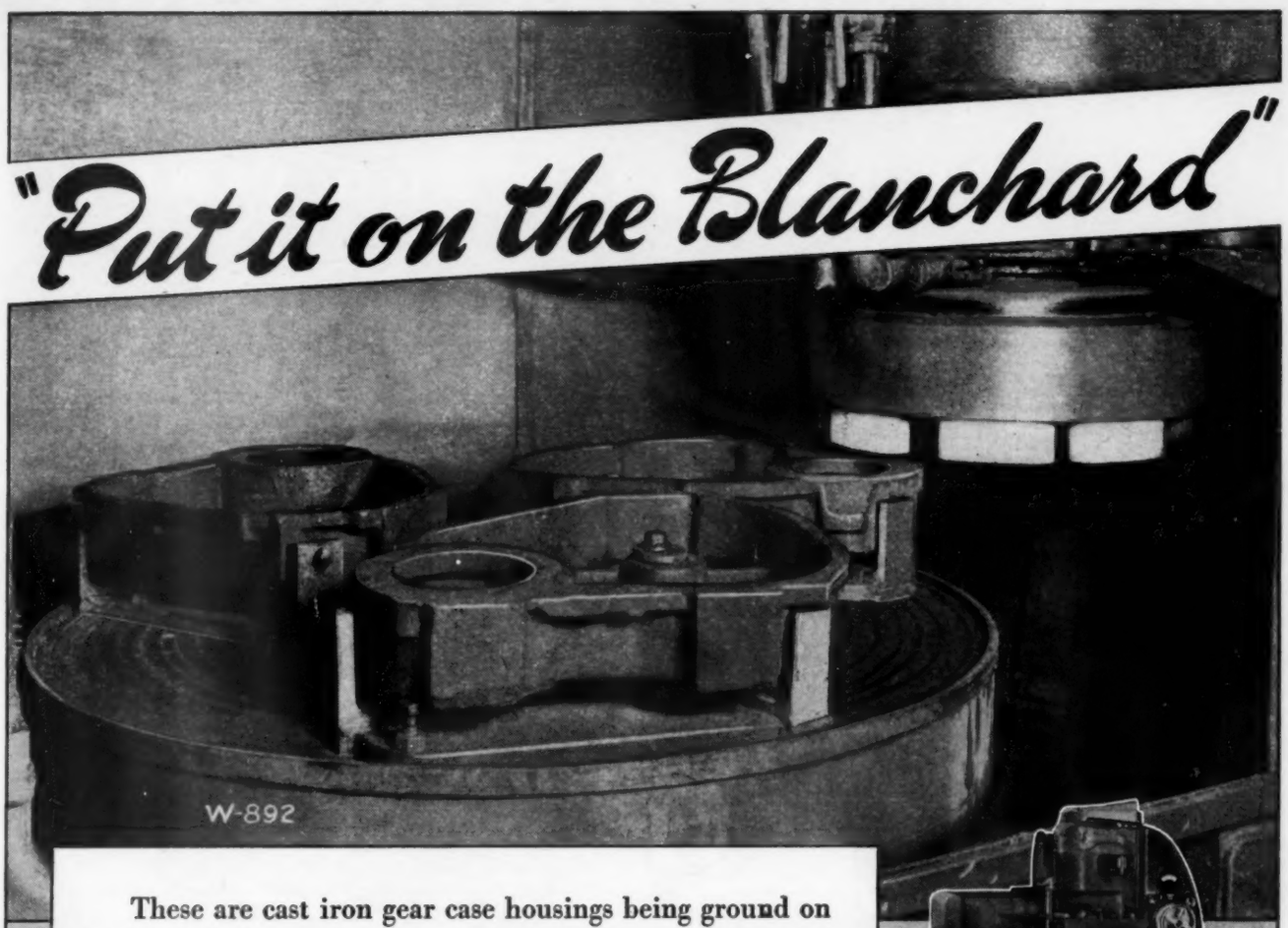
Time saved in machining operations helps speed the flow of production, reduces manufacturing costs, and increases profits. A few seconds cut from each operation are highly important. Machine tools that are easy to operate, that can handle a wide variety of operations, consistently produce work to specified tolerances and finish, and stay "on the job" day after day with a minimum of maintenance, are profit-producing installations. Because South Bend Precision Lathes offer these, and other outstanding advantages, they are the choice of leading industries and shops everywhere. A South Bend Lathe distributor near you will be glad to help you select the lathes and equipment best suited to your requirements. Write today for his name and a copy of Catalog 100-D which illustrates in full color and completely describes the entire line of South Bend Precision Lathes and Attachments.

LATHE BUILDERS SINCE 1906

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET • • • SOUTH BEND 22, INDIANA

"Put it on the Blanchard"

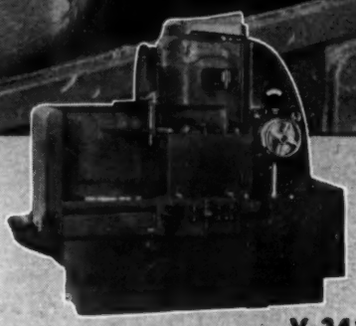


These are cast iron gear case housings being ground on a No. 18 Blanchard Surface Grinder—another demonstration of increased production of large work over former method.

They are held on a 42" magnetic chuck, three pieces per load, and 1/8" to 3/16" of stock is removed from the surface.

Production is at the rate of 8 to 9 per hour, a substantial increase over the former method of machining when only 2 were produced per hour.

When flat surfaces are required to provide oil-tight joints, "put it on the Blanchard" and also get increased production.



V-348

Get These Advantages...

PRODUCTION ✓
ADAPTABILITY ✓
FIXTURE SAVING
OPERATION SAVING
MATERIAL SAVING
CLOSE LIMITS
FINE FINISH
FLATNESS ✓

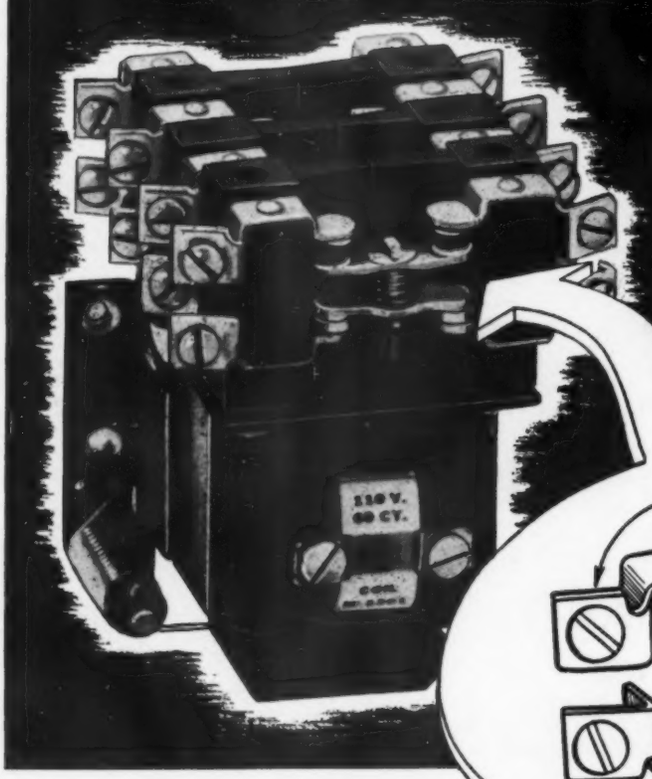
Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

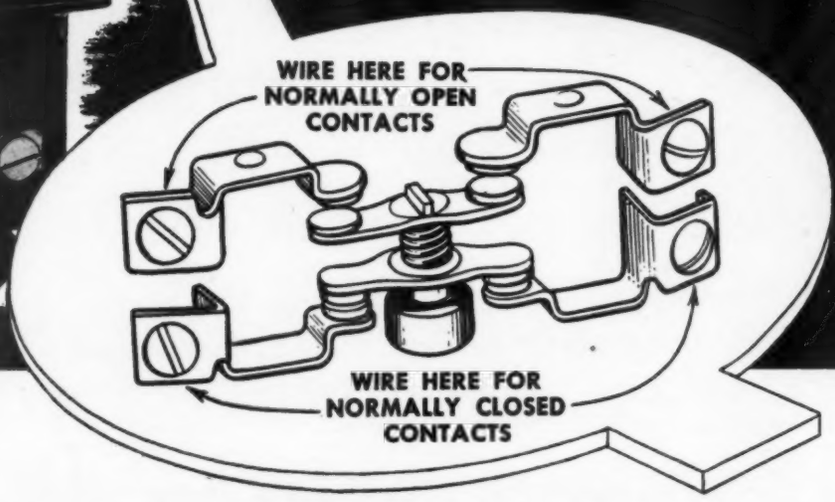
The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

A NEW ADDITION TO THE BULLETIN 700 LINE



UNIVERSAL *Solenoid Relays*



Change from NORMALLY-OPEN Contacts to NORMALLY-CLOSED Contacts *by Simply Shifting Connections*

Now you do not need to provide extra relays to take care of control circuit changes—the new Allen-Bradley Bulletin 700 Universal Solenoid Relays will handle them by a simple shift of connections. Available with 2, 4, 6, and 8 poles, these new relays are the best answer to a vital need in the machine tool industry.

In common with the other units of the popular Bulletin 700 line, these Universal Solenoid Relays are simple, rugged, and compact. The solenoid mechanism used in the new Universal Relays, as well as in other Bulletin 700 relays, is good for millions of trouble-free operations. It has no pins, pivots, bearings, or hinges—sources of sticking and binding. These new relays also use the same time-proven double break, silver alloy contacts that never require maintenance. Write for full details. Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

It is reported that . . . . . .

General Electric engineers have devised a method of measuring the temperature inside a gas turbine by making some of the parts of a special chrome cobalt alloy which changes color with increasing heat.

get ready with CONE for tomorrow

New Holland Machine Co. expects to be ready to market a new flame cultivator that is expected to weed cotton at a cost of less than fifty cents an acre.

get ready with CONE for tomorrow

Patent 2,393,594 covers the use of ammonium nitrate in liquid anhydrous ammonia as a fuel for internal combustion engines. Since this fuel contains its own oxygen, an engine using it could operate at high altitudes without dependence on the atmosphere.

get ready with CONE for tomorrow

A novel automobile, designed by Preston Tucher of Ypsilanti, Michigan, now in the road-test stage of development, is reported to have many unique features, such as front fenders that turn with the wheels, three headlights that are dimmed by a photo-electric cell, sealed radiator and center steering wheel. The two-, four- or six-cylinder opposed engine has an aluminum block and fuel injection, but no flywheel and is placed between the two rear wheels. A liquid "torque converter" replaces clutch, transmission, drive shaft and differential.

get ready with CONE for tomorrow

Businessmen will soon be offered a triangular desk made of novel woods by Fletcher Aircraft Corp. of Pasadena.

get ready with CONE for tomorrow

New York Central has a hot box alarm on its new passenger cars that signals by both smoke and smell.

Pennsylvania Railroad has a new machine that prints tickets as they are sold and also takes care of the ticket seller's bookkeeping.

get ready with CONE for tomorrow

Sacro Mfg. Corp. of Bethlehem, Pennsylvania, has an under-the-sidewalk electrical snow-melting system, designed by A. M. Byers Co., that is set in operation by the weight of snow.

get ready with CONE for tomorrow

General Electric expects to deliver the country's most powerful electric locomotive in 1946: weight 500 tons, length 143 feet, 8000 horsepower.

The Bell System will test mobile radio-telephone service for automobiles on three highways: New York-Albany-Buffalo, Chicago-Springfield and New York-Boston.

get ready with CONE for tomorrow

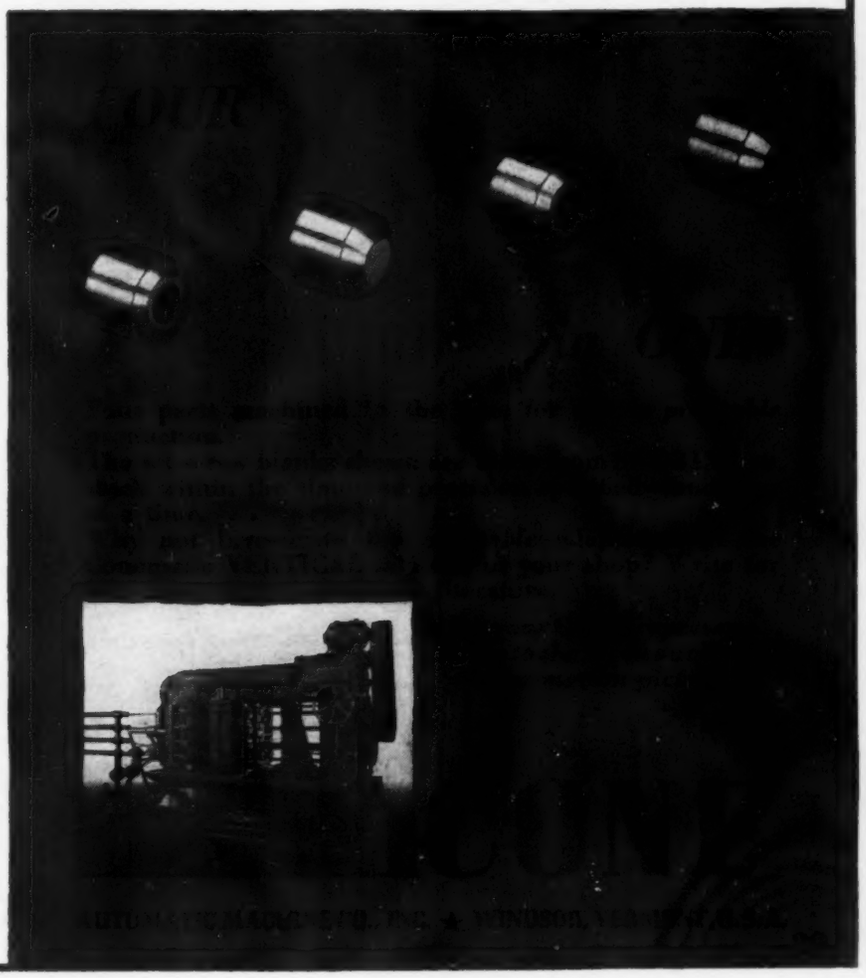
The modern trend in retail store architecture has resulted in the triple expansion of the Pittsburgh Plate Glass Company's Pittco plant, that makes metal trim for all glass store fronts.

get ready with CONE for tomorrow

One of the new ideas in jet engines, developed by Carney Associates Ltd., New York, has two cylinders firing alternately and intermittently in such a way as to make rotating parts for air supply unnecessary.

get ready with CONE for tomorrow

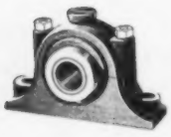
Pontiac, Michigan, is experimenting with a small house, one-third of which is rolled aluminum. It is not prefabricated, but built on the site.

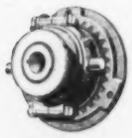


TRANSMISSIONEER...

WHO'S HE?

He's a graduate of a Dodge factory course, qualified by intensive training and a broad practical experience to give you the latest answers to problems in efficient mechanical transmission of power—in your plant or as applied to your product.





The Transmissioneer is backed by a broad line of Dodge bearings, sheaves, pulleys, clutches and other drive components. He is qualified by training and experience to select elements which make *the right drive for the job.*

Typical of the engineering advancement which marks Dodge products is the new Taperlock sheave, which has the simplest, surest mechanism ever devised for fastening wheels to shafts. For information about Taperlock—and other new developments in the mechanical transmission of power, call the Transmissioneer — your local Dodge distributor. Most power drive requirements can be supplied direct from the distributor's stock.

Look in the classified telephone directory under "Power Transmission Equipment" for your Transmissioneer's name and number. Call him for advice—without obligation.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

To obtain his diploma every Transmissioneer must pass an intensive course of training at the Dodge factory. Lectures, classroom work and practical demonstrations of power transmission problems make up the course.

DODGE
MISHAWAKA

THE SYMBOL THAT CAME TO LIFE

257 factory graduate Transmissioneers wear this sign of a nation-wide personal service that helps you put all your power into the job.

Copyright, 1946, Dodge Mfg. Corp.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

do you have Oil Seal Troubles?

Superfinish can solve them!

For example, here's the case where a shaft with two oil seal bearings was installed with ground surfaces. Driven by a ¾ h.p. motor at 1,750 r.p.m., the oil seals created enough heat to burn the shaft and stop the motor. To make matters worse, it was later found that twice the original speed was necessary.

These oil seal surfaces were *Superfinished* and a new motor installed which turned the shaft at 3,500 r.p.m. With the *Superfinished* surfaces, no heat was developed at this increased speed. No further trouble was encountered.

Superfinishing is a quick, simple and inexpensive process. Oil seal bearings are but one of the many applications where it can save money, not only by eliminating trouble, but in many cases, by reducing your manufacturing costs as well. Gisholt engineers are ready to advise you concerning its applications.

GISHOLT MACHINE COMPANY

1215 East Washington Ave. • Madison 3, Wis.

Look Ahead...

Keep Ahead...

with Gisholt...

GISHOLT

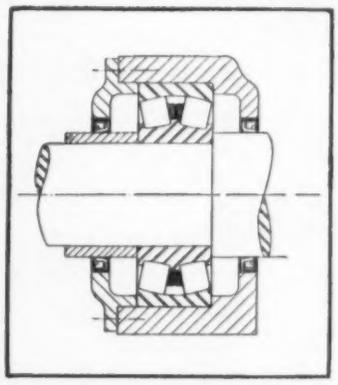
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

FOR HEAVY-DUTY SERVICE IN MANY INDUSTRIES

In every industry where the efficient operation of heavy-duty machinery is of major importance, difficult friction problems are being solved with the versatile Torrington Self-Aligning Spherical Roller Bearing.

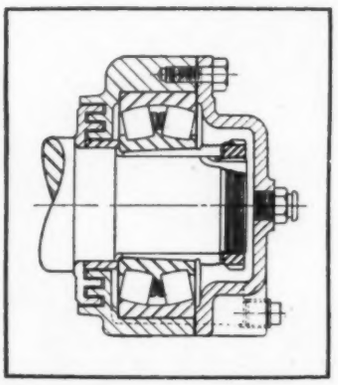
For your specific requirements, the engineering staff of Torrington's Bantam Bearings Division will be glad to offer expert assistance in adapting the Self-Aligning Spherical Roller Bearing to machinery you design, build or operate. For further information, contact your nearest Torrington Representative or write for our Bulletin No. 100A.

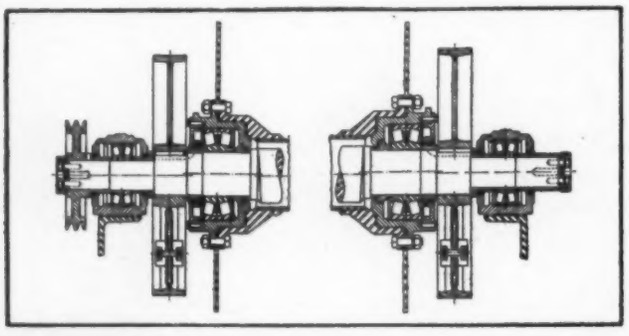
THE TORRINGTON COMPANY
BANTAM BEARINGS DIVISION, SOUTH BEND 21, INDIANA



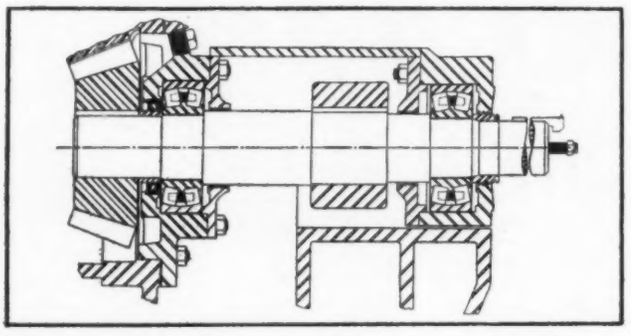
STEEL... X-section drawing shows a typical arrangement for the Torrington Self-Aligning Spherical Roller Bearing in modern, high speed auxiliary equipment for steel mills. Temperature changes, misalignment and high load stresses do not affect the free-rolling action within the bearing. Its greater inherent capacity under variable conditions provides wide adaptability.

PAPER... This X-section shows an application of a taper bore Spherical Roller Bearing to a press roll, where it is mounted on a straight shaft by means of an adapter. Through the use of this tapered sleeve, the internal running clearance is controlled by the amount of expansion given the inner race. Proper roller contact with both races assures full capacity under all conditions.





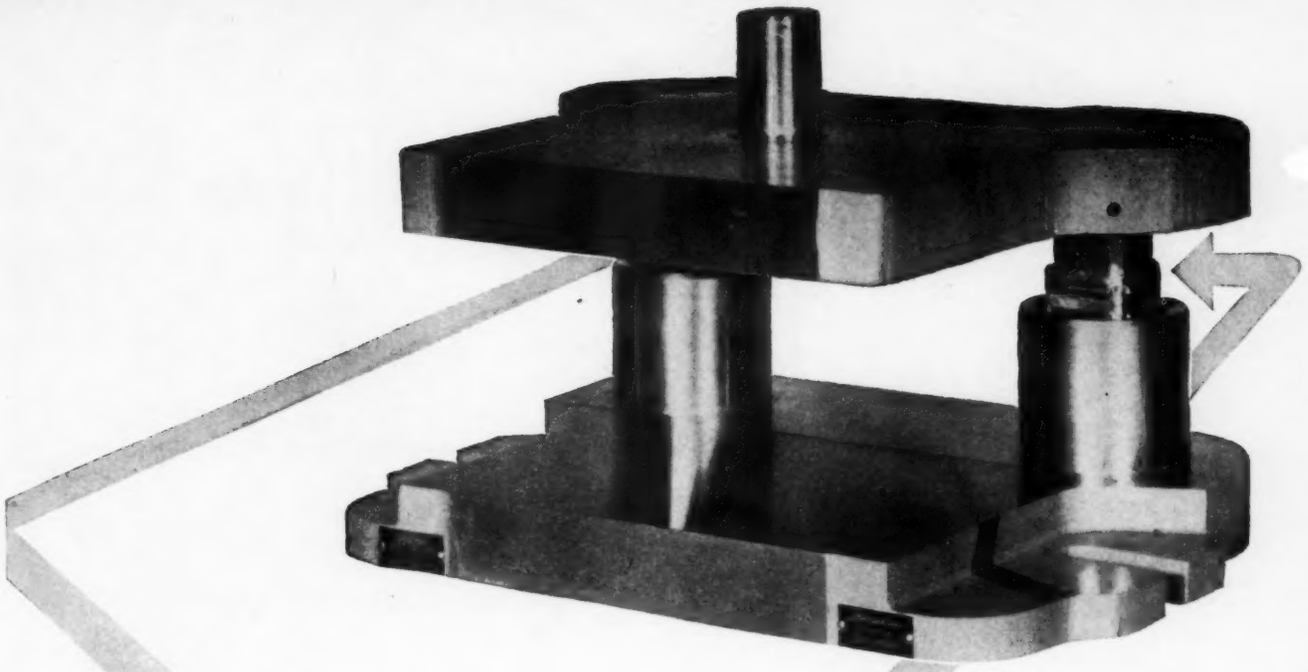
CONSTRUCTION... This X-section drawing shows a mounting of four Torrington Self-Aligning Spherical Roller Bearings on the main eccentric shaft of a shaker screen. The self-aligning feature of the bearings easily compensates for distortion and satisfactorily handles heavy shock loads.



OIL... Shown in X-section above are two Torrington Self-Aligning Spherical Roller Bearings applied to a pinion shaft as used in oil field rotary table drives. Heavy shock loads and shaft deflections do not affect the efficient free-rolling self-alignment of the bearing in this application.

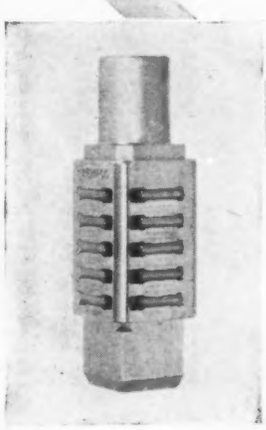
TORRINGTON BEARINGS

SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

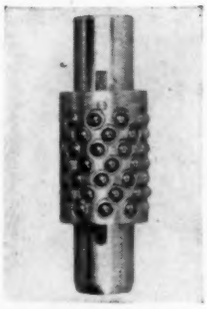


A New Feature

HAS BEEN ADDED



SQUARE PIN
ROLLER BEARING



ROUND PIN
BALL BEARING

To cut repairs—to reduce downtime—to increase production—use Lempco Anti-Friction Die Sets.

These are the only sets equipped with ball or roller bearing guide pins which makes it easy to set up dies by hand without the use of hammers, mauls, jacks or pry bars. This eliminates expensive accidents to dies and punches—saves up to 60% of mechanics' time and permits fast press speeds.

All bearings made with .0015″ pre-load to eliminate "play" between the pin and bushing. Over 18,000,000 strokes in actual production failed to destroy pre-load and proved that this feature guarantees long die life —assures greater production between sharpenings.

For complete details on the revolutionary Lempco Precision Anti-Friction Die Sets, write for catalog.

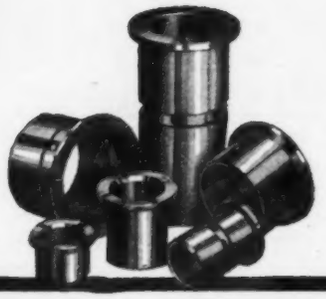
Licensed under Inventions of Guy Conner

LEMPCO

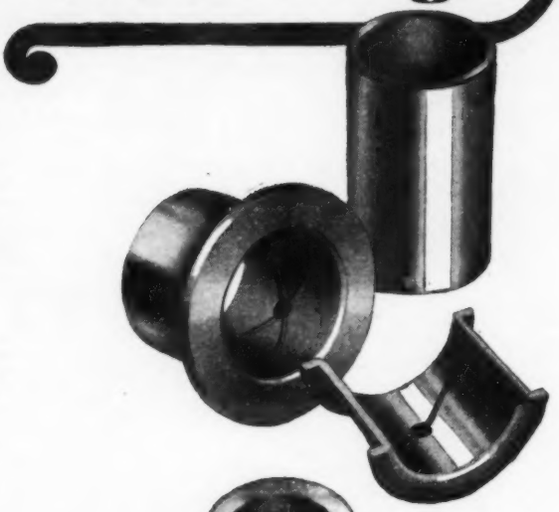
5711 DUNHAM ROAD
BEDFORD, OHIO, U.S.A.

There is

ONE RIGHT SOURCE



for Sleeve Type Bearings



There are several reasons why many leading manufacturers regard Johnson Bronze as the RIGHT source for *all* their Sleeve Bearings. For instance, we are the only bearing manufacturer that produces ALL types of Sleeve Bearings. This enables us to help the purchaser select the correct bearing for each application. It permits us to give sound bearing advice . . . based on facts . . . without prejudice for any one type. Every bearing we produce is manufactured complete in our plant . . . from molten metal to finished product. Thus we have constant control over every step in the process. We manufacture only one type of product . . . Sleeve Bearings. All of our facilities, our resources and research has but one objective . . . to give our customers better bearings at lower cost. Isn't this the type of bearing service you have been looking for? Your inquiry carries no obligation . . . why not write TODAY?

JOHNSON BRONZE CO.

515 S. MILL STREET • NEW CASTLE, PA.

JOHNSON
SLEEVE BEARING HEADQUARTERS
BRONZE

The modern plant of Johnson Bronze. Over four acres devoted exclusively to the complete manufacture of Sleeve Type Bearings.

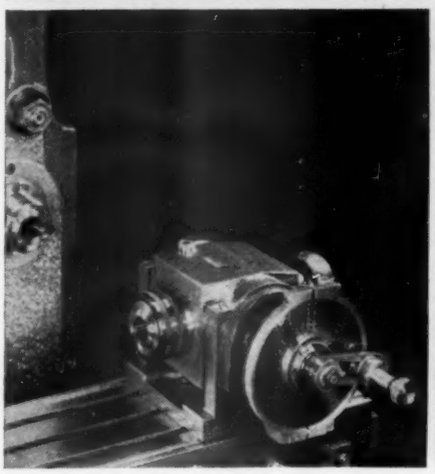
Unusual Capacity Describes

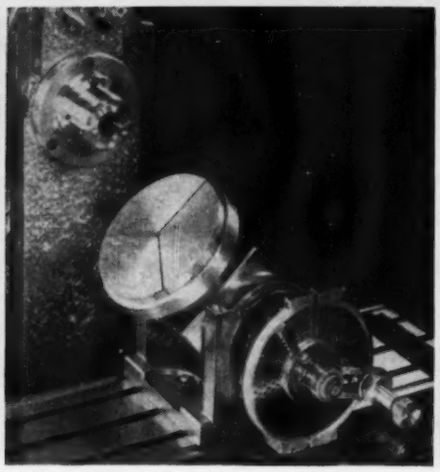
The HARDINGE Precision Dividing Heads

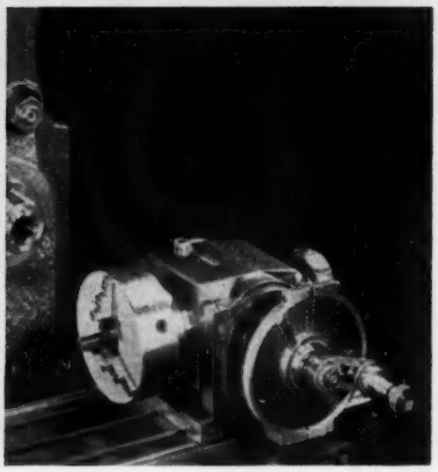
ELMIRA, N.Y.

THESE ARE FEATURES WHICH YOU GET WHEN YOU PURCHASE HARDINGE TM OR UM MILLING MACHINES.

WRITE FOR BULLETIN TM-UM







1" COLLET CAPACITY

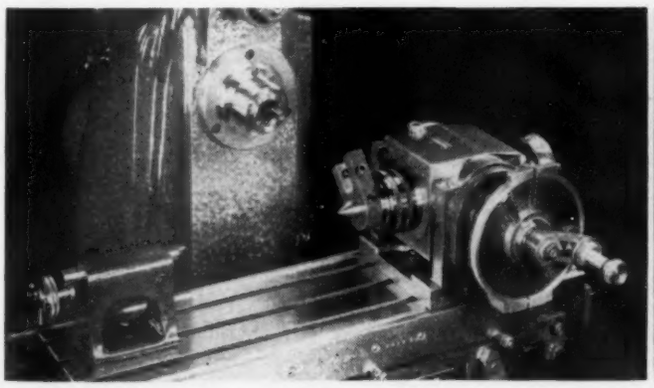
5C HARDINGE Collets fit directly into the spindle — providing a through spindle capacity of 1". The collet is the same as used in the cutter spindle. Collets can be used with the dividing head set at any angle from horizontal to the vertical position.

6" STEP CHUCK CAPACITY

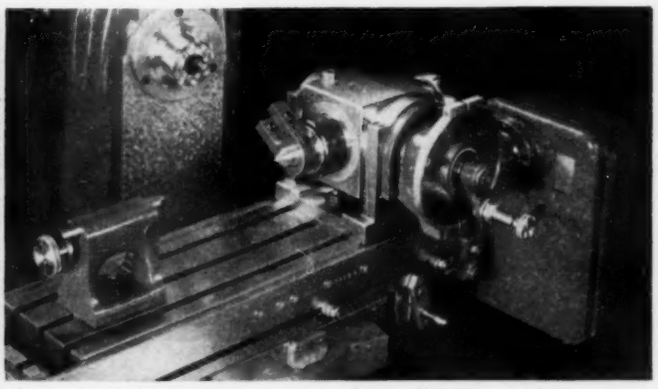
The dividing head spindle takes standard step chucks and closers, providing collet type chucking from 1" to 6" diameters. Step chucks are available in the following capacities—2", 3", 4", 5", and 6". Step chucks can be used with the dividing head set at any angle from horizontal to the vertical position.

5" JAW CHUCK CAPACITY

Three jaw universal or four jaw independent chucks provide chucking capacity up to 5" in diameter and 1-5/32" through the spindle. The chucks have integral mounts for direct application to the spindle. The jaw chucks can be used with the dividing head set at any angle from horizontal to the vertical position.



Set-up for plain milling on HARDINGE TM Milling Machine



Set-up for spiral milling on HARDINGE UM Milling Machine

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

James Jackson
PRESIDENT

MID-WEST ABRASIVE COMPANY

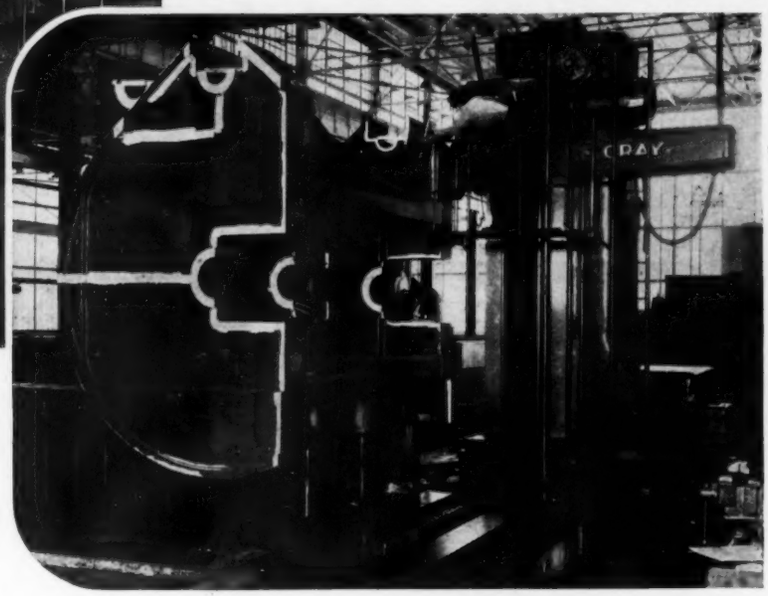
OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

BIG JOBS *made easy with* GRAY *Horizontal*

BORING • DRILLING MILLING MACHINES

5", 6", 7" *and* 8" BAR DIAMETERS



DISTINCTIVE FEATURES *that* INCREASE PRODUCTION

- The proper speed for every need, easily and quickly set.
- The 5" and 6" bars have a speed range of 200 to 1 with a high speed up to 900 R. P. M.
- The feeds of bar, head, and column are entirely independent of the spindle speed, and can be changed by simply turning the rheostat knob. Boring feeds have a range of 600 to 1; Milling feeds of 120 to 1.
- The cross travel of the column gives the machine the flexibility of a table type, with the rigidity of a floor type.

THE G. A. GRAY CO.
CINCINNATI 7, OHIO, U. S. A.

Gentlemen: Please send me without obligation on my part a copy of illustrated and descriptive bulletin No. 48.

NAME_____

COMPANY_____

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clip and mail today ➡

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
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DIE BLOCK PLANERS
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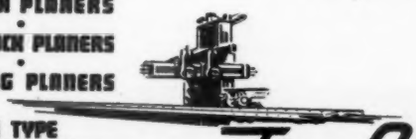
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES

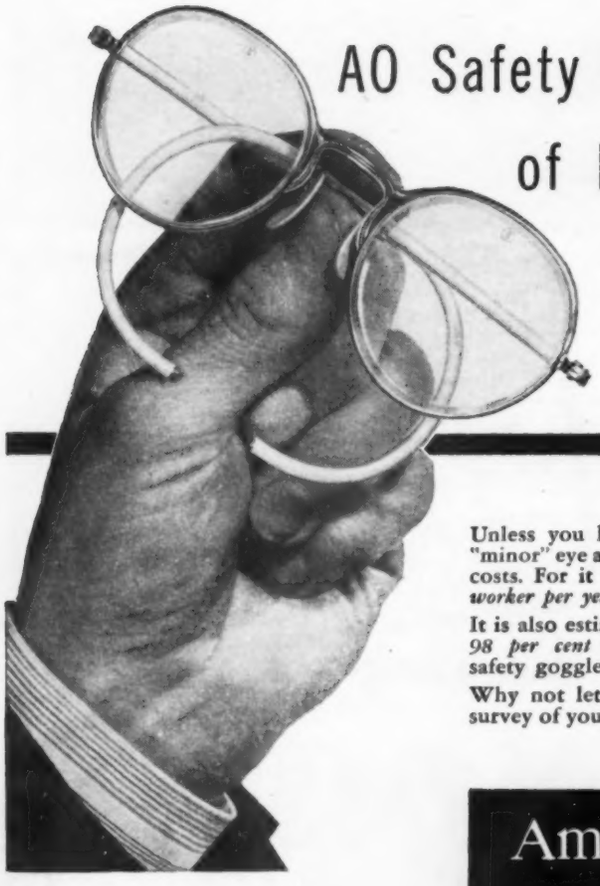


The G.A. GRAY *Co.*

CINCINNATI 7, OHIO, U. S. A.

Sold in Canada by Upton, Bradeen and James Ltd. • **Sold in Latin America by Machine Affiliates.**

You Might Be Surprised If You Check on What Eye Accidents are **Costing You**



AO Safety Goggles Safeguard the Eyes of Industry . . . **Reduce** Production **Costs**

Unless you have an adequate eye-protection program, even so-called "minor" eye accidents are probably adding substantially to your production costs. For it is reliably estimated that eye accidents run to *$5 per shop worker per year.*

It is also estimated (by the Society for the Prevention of Blindness) that *98 per cent* of these accidents are avoidable—through the use of safety goggles.

Why not let an AO Safety Representative make a complete eye-hazard survey of your plant? There's no obligation.

American Optical COMPANY *Safety Division*

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL INDUSTRIAL CITIES

THOSE VARIATIONS in PRODUCT QUALITY

● Here are five efficient and dependable "supervisors" of quality control which can help you get highest quality at low production cost. They will aid you in saving time and money, and in eliminating waste.

Our engineers can help you with your special quality control requirements. They will be glad to discuss them with you. Call our nearest office, or write Special Products Division, Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

CATCH THOSE INSULATION FAULTS *BEFORE* THEY LEAVE THE FACTORY

The G-E insulation-resistance meter will insure uniformity of your insulation materials during the manufacturing process. It measures insulation resistance over a range of 0 to 20,000 megohms. Tests on apparatus already installed indicate condition of insulation, so that correction can be quickly made. Also makes possible study of effects of temperature and humidity on insulation. Small, compact, portable—convenient for production and service testing. Simple and safe to operate. More details are given in Bulletin GEA-4174.

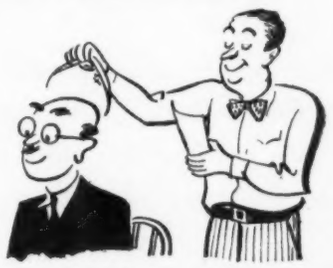
IT'S EASY TO INSPECT FERROUS MATERIALS

Here's a quick, simple, non-destructive way to maintain close quality control of apparatus such as rods, bolts, springs, and small fabricated parts. The G-E magnetic comparator tests these parts and compares them to a preselected standard. Helps you to maintain uniform characteristics in your apparatus. Bulletin GEA-4169.

MATCHES SURFACES —AT LOW COST

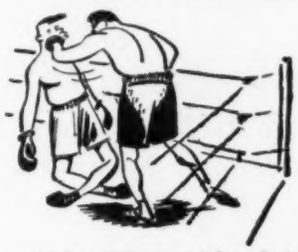
Save time, reduce production cost, avoid waste . . . with G-E standard roughness specimens. They provide a standard objective reference by which roughness and appearance of various finishes can be designated. Help reduce production costs by facilitating selection of roughest allowable finish. A quick, convenient method by which engineers, inspectors and mechanics can determine whether surfaces meet specifications. Bulletin GEA-4335.

NEED TO MEASURE THICKNESS?



Be sure coatings or sheet materials are of adequate thickness (but not too thick or wasteful). The G-E thickness gages will measure thickness of paint, copper plating, sheets of glass, plastics, paper, and other non-magnetic materials when backed by a magnetic material without marring the surface. A gage head is placed on the surface (flat or curved), and an instrument indicates the thickness. Three types of gage heads are available for the sensitivity desired. Bulletin GEA-4363.

STRAIN, PRESSURE, SHOCK . . . VIBRATION



The strain-gage amplifier helps to measure these by amplifying the electric output of suitable detector units. Supplies sufficient electric output for recording or indicating instruments. By using this amplifier, oscillograph records can be made of strains, vibrations, accelerations, shock, pressure which may vary in frequencies from 0 to 1000 cycles per second. Easy to use and adjust. Write for Bulletin GEA-4226.

GENERAL ELECTRIC

General Electric Company, Section 800-21
Schenectady 5, New York

Please send me the bulletins checked below:

- ☐ GEA-4174—Insulation-resistance meter
- ☐ GEA-4169—Magnetic comparator
- ☐ GEA-4335—Standard roughness specimens
- ☐ GEA-4363—Thickness gages
- ☐ GEA-4226—Strain-gage amplifier

Name.....

Company.....

Address.....

City.....State.....

8851

Ask Yourself this Question:

COULD A *Special* FABRIC DO IT?

If you have any manufacturing or industrial problem that could or *might* be solved by a special fabric, the chances are we can make a cloth to meet your requirements.

Just tell us what you want the cloth to do. — Give us the specifications. What tensile strength (pounds per square inch) do you want? What tear strength (Elmendorf) should it have? What caliper (thousandths of an inch)? What stiffness (Gurley)? Do you want it waterproof? What temperatures must it withstand? How about solvents, acids and alkalis? What dielectric characteristics are necessary? These are the things we want to know.

By filling, impregnating or coating various fabrics (from sheer cambric to coarse burlap) with plastics, resins, starch and pyroxylin we can produce a cloth with almost any wanted properties. Write our Research Department today.

Cloth Bound

A cloth bound book is bound to be kept — bind your

CATALOG — SALES MANUAL — INSTRUCTION BOOK, ETC.

in HOLLISTON Book Cloth — durable, impressive, hard-to-soil, easy-to-clean.

Write for samples.

Consult your printer.

SPECIAL FINISH

HOLLISTON special finish cloths meet special needs —

TRACING CLOTH — PHOTO CLOTH — RUBBER (PROCESSING) CLOTH — BOOK CLOTH — SHADE CLOTH — SIGN CLOTH — TAG CLOTH.

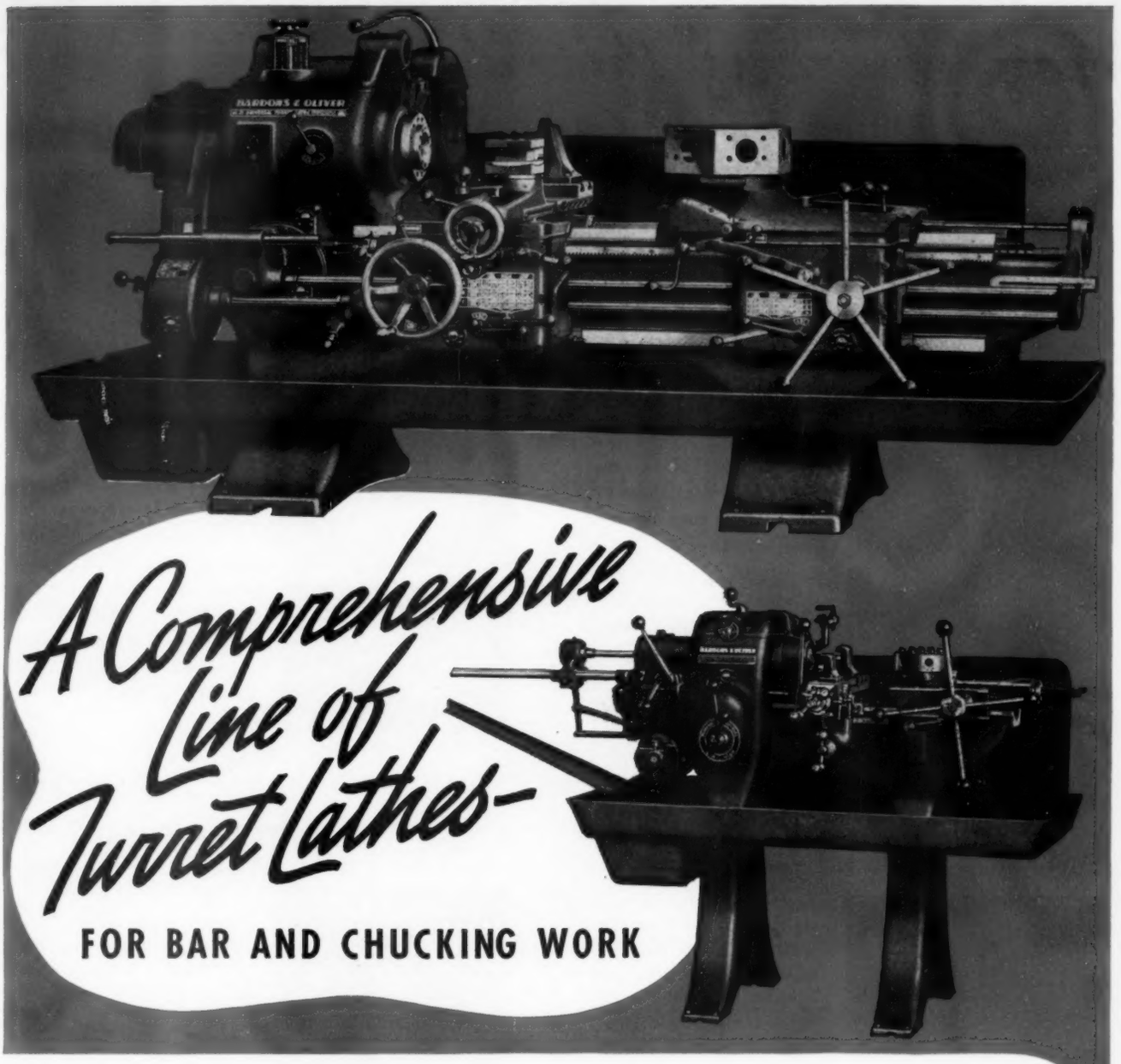
Cloth combined with special compounds, filled, impregnated, coated — to form a material with characteristics of a plastic and the flexible strength of a woven fabric.

HOLLISTON

Special Purpose Fabrics

The Holliston Mills, Inc.

Norwood, Massachusetts



A Comprehensive Line of Turret Lathes—

FOR BAR AND CHUCKING WORK

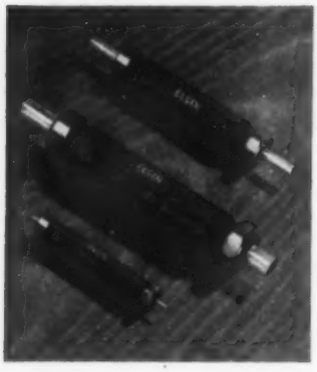
The range of the Bardons & Oliver line of turret lathes covers bar work from 1/8 inch diameter or smaller to forgings or castings up to 15 inches. Each size in the line is outstanding in its own field for fast production and high quality work. In this era of keen competition and high wage standards Bardons & Oliver Turret Lathes will lower production cost and raise profit margin.

We suggest you submit your production problems and blue prints of your turret lathe work to our tool engineers for study and recommendation.

BARDONS & OLIVER, INC.
1133 WEST 9TH STREET • CLEVELAND 13, OHIO

5 WAYS in which the amazing wear resistance of ELGIN Sapphire serves industry...

1. PLUG GAGES



Outwearing steel more than 7000 to 1! This means *savings* in replacement costs, worn gage rejects, gage checking time plus improved and increased production. Single and double end styles. Sizes from .040 to .400. Tolerances down to .00002. No "wear allowance" necessary—order right to size.

2. RING GAGES

Made of same hard, nonwearing Sapphire as Elgin Plug Gages. One manufacturer got 1,100,000 gagings as compared with 150 from steel. Sizes as small as .004. Tolerances down to .00004. Available in single ring and twin ring styles.

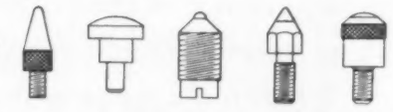
3. SAPPHIRE TIPT MICROMETERS

A superbly engineered lightweight micrometer with tough Elgin Sapphire mounted on the anvil and spindle. Original one still in use after more than 2,000,000 gagings. A micrometer to give readings you can be sure of. Guaranteed to .0001 accuracy. Available in one, two and three-inch sizes for immediate delivery.

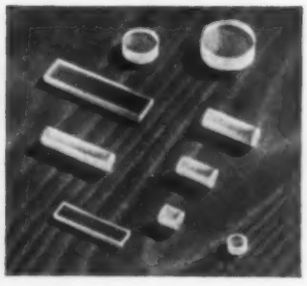
4. DIAL INDICATOR CONTACT POINTS

Another proved application of Elgin Sapphire. Better work at a savings because these points cannot scratch or mar surfaces. Dimensionally stable. Unaffected by acids. Non-porous. Monocrystalline. Standard 4-48 thread or to your specifications.

Examples of various contact points we have made.



5. STANDARD SHAPES



Rectangles, cylinders, round flats. You can easily affix these pieces to the wear surfaces on machines, tool rests, gages, etc. Stock items ready for immediate shipment.

SPECIFY ELGIN SAPPHIRE FOR DIMENSIONAL FIDELITY IN GAGING OPERATIONS

SAPPHIRE PRODUCTS DIVISION
ELGIN NATIONAL WATCH COMPANY, AURORA, ILLINOIS
Representatives in cities from coast to coast

Carburs PRODUCED BY MEN WHO *Know* CEMENTED-CARBIDES

Over a number of years, Lincoln Park's history has shown a series of "firsts" in application of cemented-carbides to the manufacture of gages and tools. One of these was the introduction of Carburs—industry's first cemented-carbide rotary files.

Today, Carburs have been thoroughly proven in every type of production. Original claims that their service life would be "at least 50 times that of steel rotary files" have, in numerous instances, been greatly exceeded. Every other claim for performance and production cost reduction has been more than fulfilled.

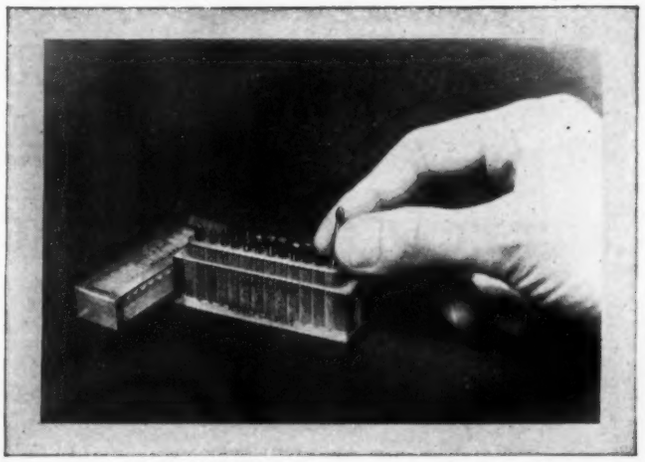
If you use rotary files, you'll find many advantages in those made of cemented-carbide. To be sure that you get the best, you'll find it will pay to specify *the original* cemented-carbide rotary files . . . manufactured by a company with unexcelled experience in cemented-carbide work . . . and that still rank far ahead in sales of tools of this type. They are Carburs —made by Lincoln Park.

MIDGET CARBURS

Carburs in midget sizes, 1⅛ inches overall with ⅛ inch diameter shanks, are available for tool room, die shop, pattern shop and general production use. They are made of solid cemented-carbide.

Midget Carburs are supplied as individual tools or in sets of twelve tools of assorted shapes furnished in an extremely practical and attractive plastic case.

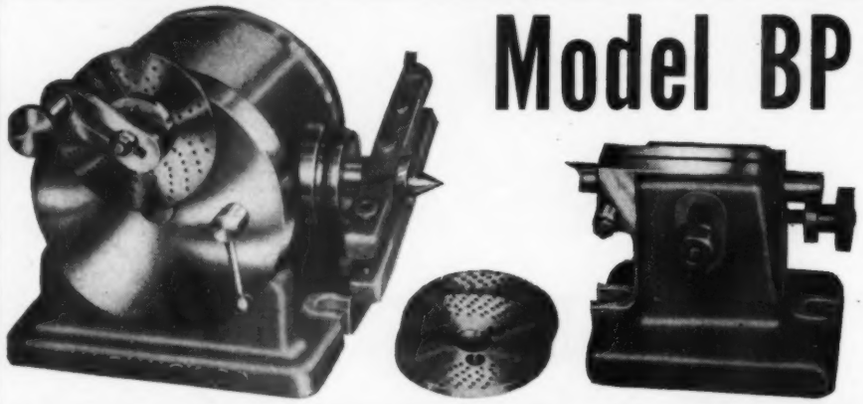
NEW LITERATURE SHOWING ALL CARBURS NOW AVAILABLE AND LISTING NEW REVISED PRICES WILL BE SENT YOU UPON REQUEST.



Lincoln Park INDUSTRIES, INC.

1721 FERRIS AVENUE • DETROIT 25, MICHIGAN

L-W Rugged, Low Priced, High Quality 11″ Universal Dividing Heads



Model BP for plain milling machine

$151.20

Model AU Full Universal

for complete indexing and spiral cutting

$219.15

HEADSTOCK—Ruggedly designed for maximum rigidity. Can be swiveled to any angle.

TAILSTOCK—Heavier, stronger design.

HEADSTOCK SPINDLE—Tapered bearings, bored for No. 10 B & S Taper. Increased diameter and length. Threaded nose, 2¼″ diameter 10 thread USS.

WORM—Made from special alloy steel, accurately finished, end thrust taken by ball bearings. Easy, accurate adjustment of worm wheel.

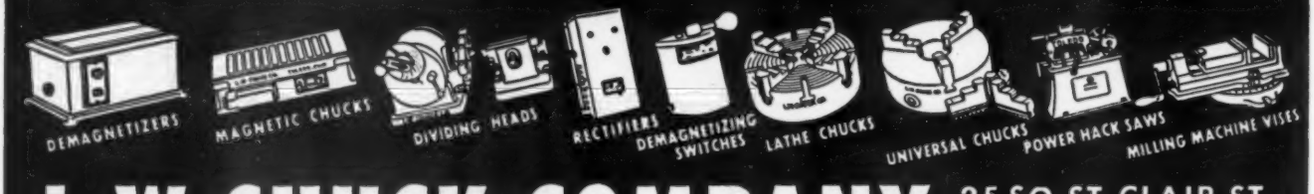
WORM WHEEL—Large diameter, 40:1 ratio, accurately generated, securely mounted on spindle.

EQUIPMENT—⅝″ table slot tongues, three index plates, dividing all numbers to 50, and even numbers to 100, with the exception of 96T. Index chart shows all divisions obtainable to 380.

When ordering AU Heads, specify either right or left hand model.

Utmost accuracy at a cost lower than any comparable equipment on the market!

Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products



L-W CHUCK COMPANY 25 SO. ST. CLAIR ST. TOLEDO 4, OHIO

Your Most Direct Source of Information ON

GEAR SHAVING

Red Ring Gear Shaving Machines correct gear cutting errors and improve gear tooth surfaces on spur and helical gears up to 220" PD.—Also to develop Elliptoid tooth form on gears up to 36" P.D.

GEAR LAPPING

Red Ring Gear Lapping Machines process spur, helical, shoulder and cluster gears removing heat treat distortion and giving fine finish.

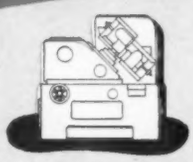
GEAR SOUND TESTING

By testing a pair of gears on a Red Ring Sound Tester you determine before assembly the type of bearing and the noise factor when encountered.

GEAR CHECKING

The Red Ring Universal Gear Checker shows quickly and accurately errors in index, helix angle, tooth size, eccentricity, interference and wobble.

ROTO SHAVING

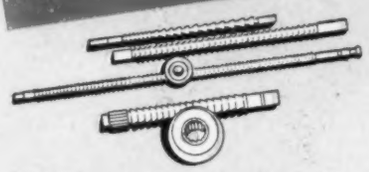


The Red Ring Roto Shaver finishes cylindrical, conical and flange surfaces faster and more effectively than can be done by green grinding.

ROTO MILLING

The Red Ring Rotomill Machines cylindrical work, conical work and flanged parts faster and more economically than can be done on a lathe.

BROACHES



Red Ring Naloy Broaches because of the methods of fabrication and treatment give you 50% more production per grind than conventional tools.

NATIONAL BROACH REPRESENTATIVES

BUFFALO 7, NEW YORK
George Keller Machinery Co.
1807 Elmwood Avenue

CHICAGO 6, ILLINOIS
C. L. Glover and C. E. Hartley
565 W. Washington Blvd.
Room 308

CLEVELAND 13, OHIO
Wyatt Sales Co.
Rockefeller Bldg.

DAYTON 9, OHIO
Walter R. Olt
306 Abington Road

DENVER, COLORADO
Hendrie & Bolthoff Mfg. & Supply Co.
1635 Seventeenth St.

FLINT, MICHIGAN
Hall Sales & Engineering Co.
920 Walnut Street

FORT WAYNE 6, INDIANA
I. R. Thornburg
3717 Hoagland Avenue

GRAND RAPIDS, MICHIGAN
Joseph Monahan
351 Indiana Avenue, N. W.

HOUSTON, TEXAS
Huge-Fayle Company
1011-13 Caroline Avenue

LOS ANGELES 11, CALIF.
Machinists' Tool & Supply Co. (Broaches)
3690 Santa Fe Avenue
Moore Machinery Co. (Machine Tools)
3876 Santa Fe Avenue

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F. P. Harrigan
1060 Broad Street

PHILADELPHIA 3, PENN.
Conner Machinery Company
1701 Arch Street

RACINE, WISCONSIN
Hollis V. Gordon
1602 College Avenue

ST. LOUIS 17, MISSOURI
W. H. Sheer
7430 Bruno Avenue

SAN FRANCISCO, CALIFORNIA
Moore Machinery Company
1699 Van Ness Avenue

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Hallidie Machinery Company
2245 First Avenue, South

SYRACUSE, NEW YORK
C-H Briggs Machine Tool Co., Inc.
Onondaga Hotel Building

TOLEDO 2, OHIO
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1220 Madison Avenue

WASHINGTON 6, D. C.
Glassie Co., Don Caffery
Jefferson Bldg., 1227 19th St., N.W.

WILBRAHAM, MASS.
Richard S. Brown
P. O. Box 158

WILKINSBURG, PENN.
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CANADA

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410 St. Nicholas Street

TORONTO, ONTARIO
F. F. Barber Machinery Co., Ltd.
York and Harbour Streets

WALKERVILLE, ONTARIO
F. F. Barber Machinery Co., Ltd.
Imperial Building

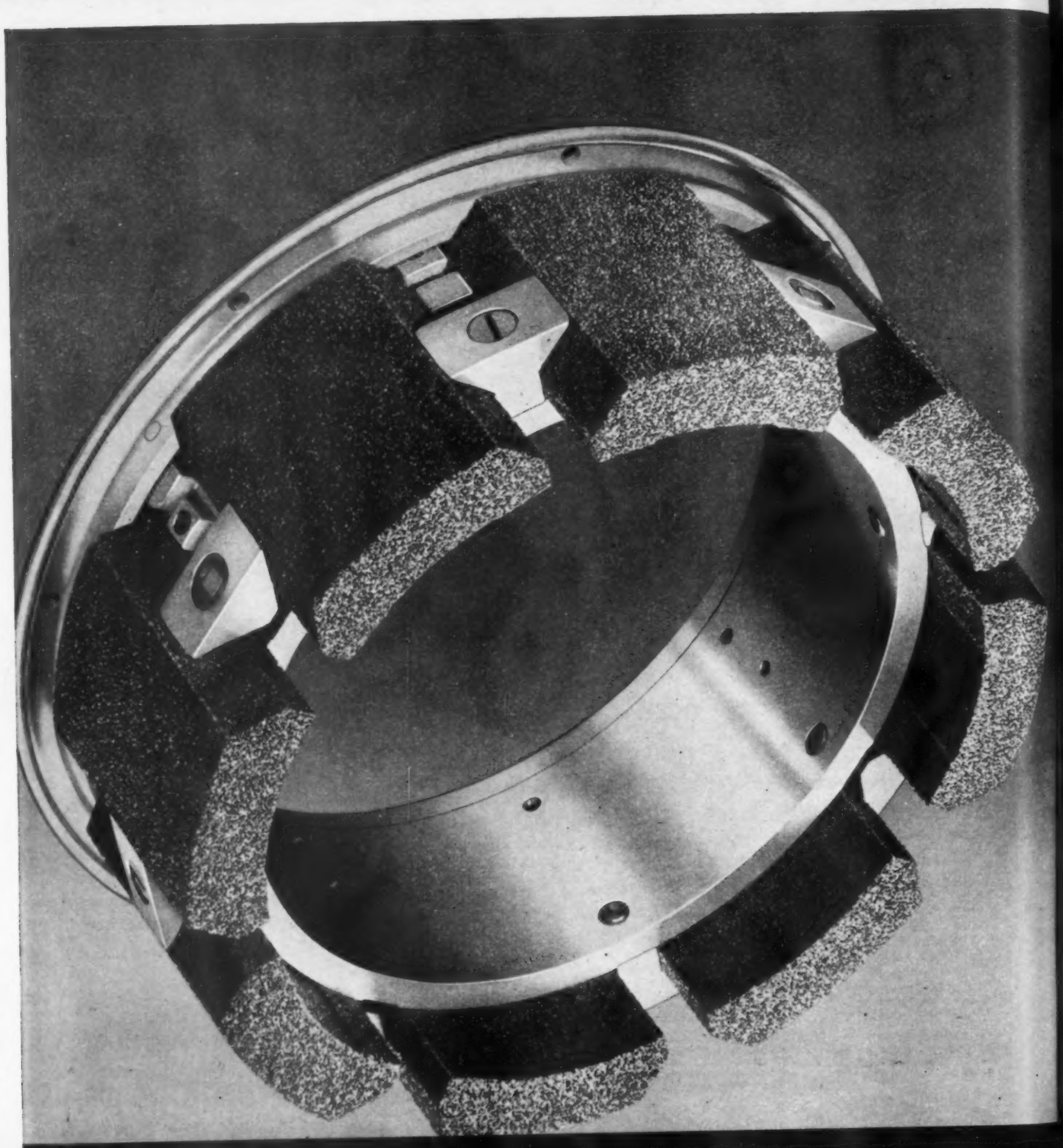
NATIONAL BROACH AND MACHINE CO.

5600 St. Jean
Detroit 13, Michigan

RED RING ◯ PRODUCTS

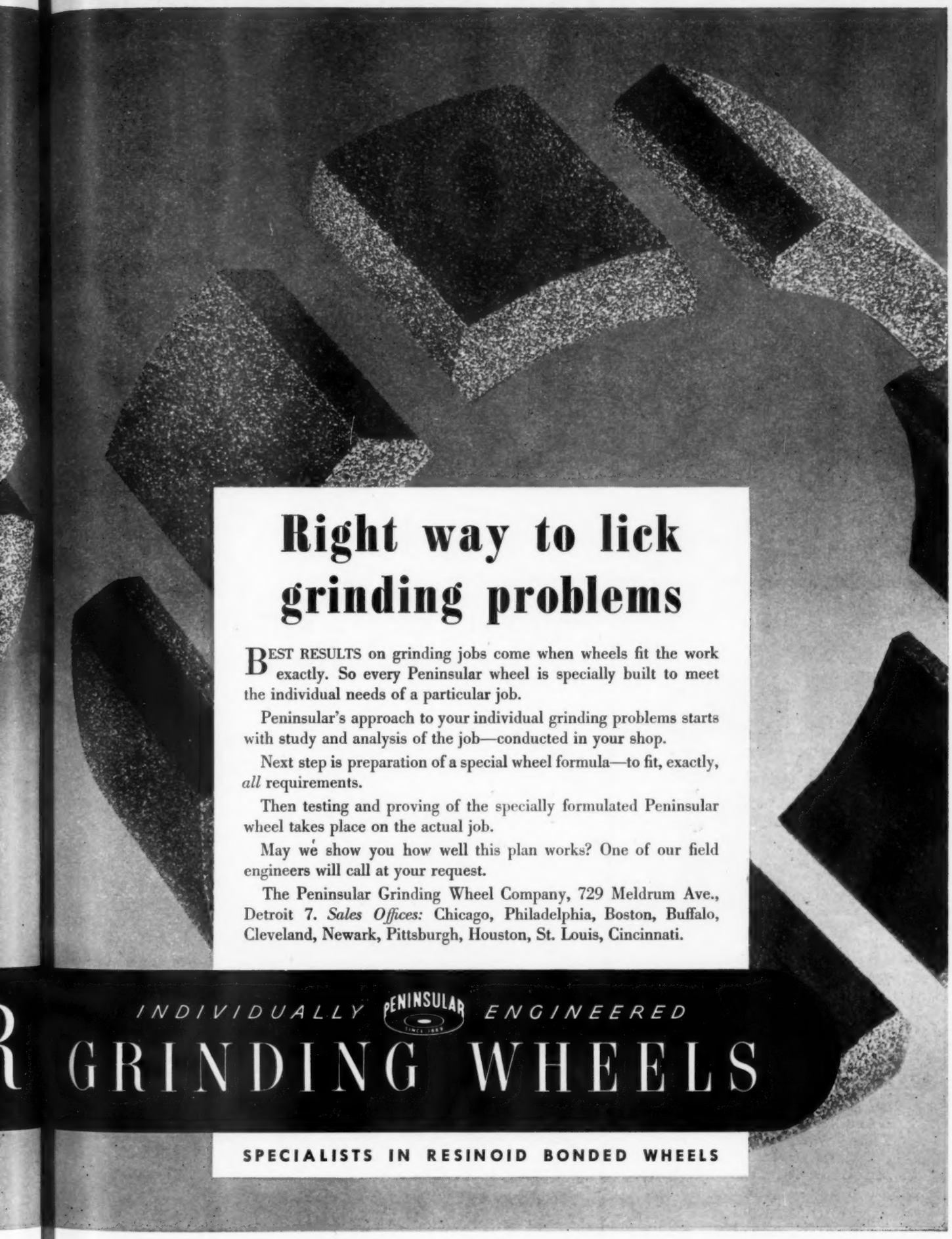
SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS



PENINSULAR

SINCE 1889



Right way to lick grinding problems

BEST RESULTS on grinding jobs come when wheels fit the work exactly. So every Peninsular wheel is specially built to meet the individual needs of a particular job.

Peninsular's approach to your individual grinding problems starts with study and analysis of the job—conducted in your shop.

Next step is preparation of a special wheel formula—to fit, exactly, *all* requirements.

Then testing and proving of the specially formulated Peninsular wheel takes place on the actual job.

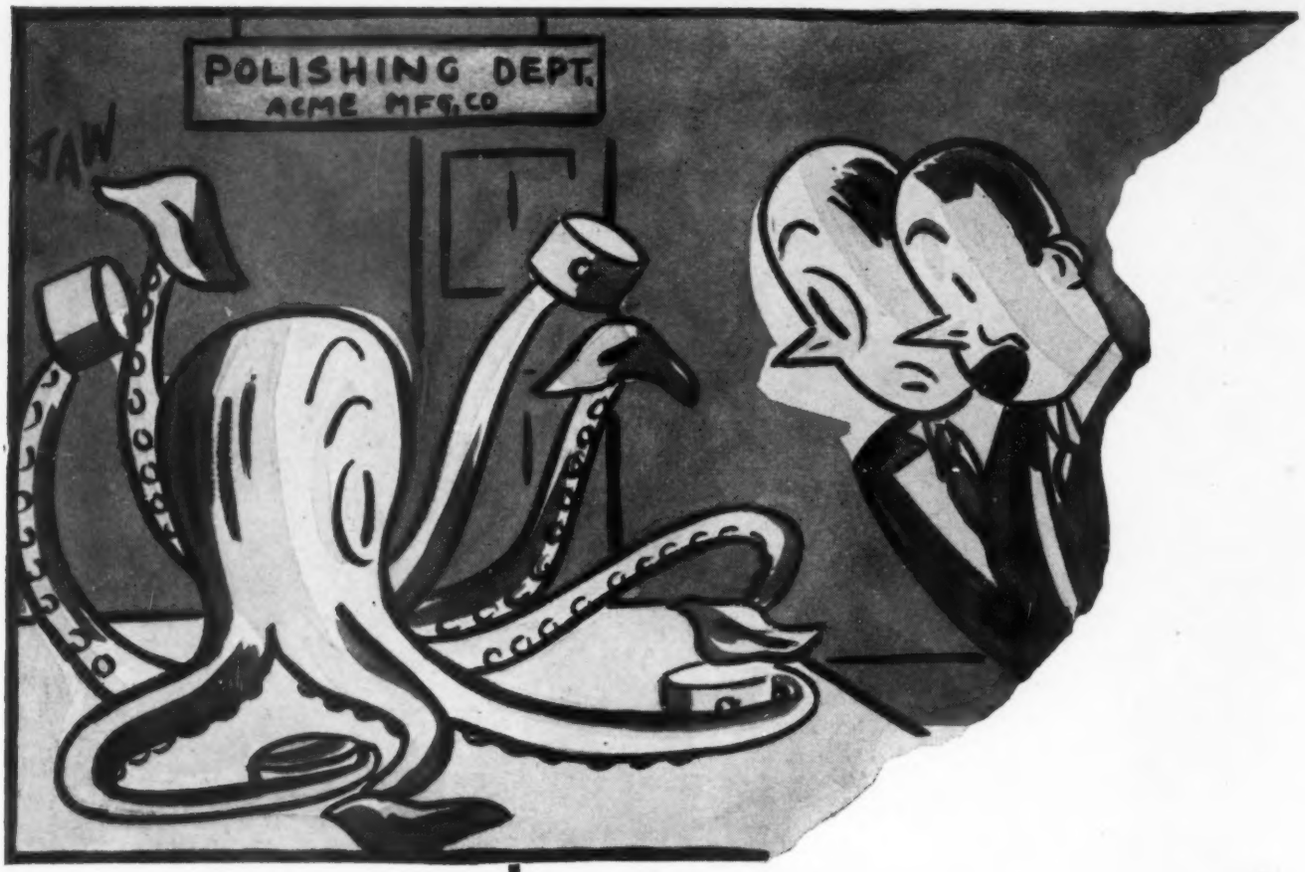
May we show you how well this plan works? One of our field engineers will call at your request.

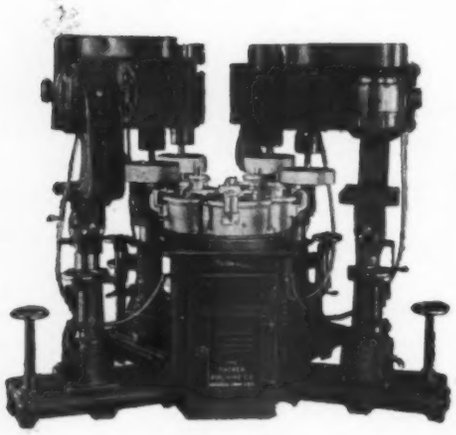
The Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7. *Sales Offices:* Chicago, Philadelphia, Boston, Buffalo, Cleveland, Newark, Pittsburgh, Houston, St. Louis, Cincinnati.

INDIVIDUALLY PENINSULAR *ENGINEERED*

GRINDING WHEELS

SPECIALISTS IN RESINOID BONDED WHEELS





No. 4-5 INDEXING TYPE WITH OSCILLATING WHEEL HEADS

There's a Packer-Matic for all shapes, metals and finishes. WRITE for Factory Time Study — SEND part and finish desired to Packer Machine Co., Meriden, Ct.

"THINK HE'S GOOD? — WAIT UNTIL YOU SEE OUR PACKER-MATIC IN ACTION!"

Even an octopus takes a back seat when it comes to multiple polishing and buffing performance. Packer-Matic automatic Polishing and Buffing Machines are simple, fast and efficient . . . eliminate all unnecessary hand-operations . . . polish and buff easier, better and economically. Install Packer-Matics to insure increased production . . . lower labor and wheel costs.

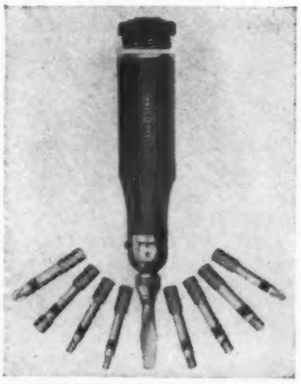
THE PACKER MACHINE CO. MERIDEN, CONN.

PACKER-MATIC

AUTOMATIC MACHINES FOR BUFFING, POLISHING, DEBURRING AND GRINDING

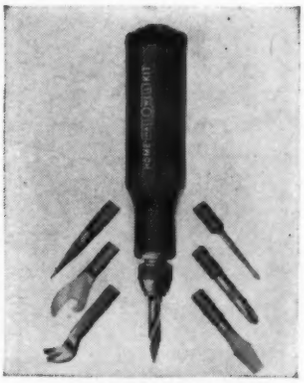
Use HALLOWELL *Speed Tool Kits*

Handles Molded Celanese Plastic*



SOCKET SCREW KIT

Socket Screw Kits (in two sizes) . . . contain interchangeable bits for driving almost any type screw. Hex bits, ranging from 1/16", increasing by 1/32 of an inch, up to 5/16"; a Phillips bit and a flat bit.



HOME KIT

Home Kit . . . the handiest kit imaginable. Contains flat screw drivers (1/16" and 1/4" wide), Phillips screw driver, square tapered reamer, gimlet, tack lifter and bottle cap opener. You'll find it indispensable.

Doesn't it sometimes get awfully tiresome, and just a little aggravating, to walk to the other end of a garage for a screw driver . . . or to lug a heavy tool box around all the time? Wouldn't it save you many steps, and make you feel much more efficient if you could carry most of your small tools right in your pocket . . . without bulk or weight?

The "Hallowell" Speed Tool Kits will accomplish this. Keep them in your pocket; tell your customers about them, so that they, too, can have them handy in the glove compartment of their car.

The "Auto" Kit has flat screw drivers, clutch head bits, and a tapered reamer. The "Socket Wrench" Kit has 6 and 12 point hex sockets, with openings from 1/4" to 3/4". Both Kits have a swivel bit-chuck for better leverage; come in two sizes for a greater range of tools.

The Kits are made with the same care and precision as all STANDARD products, with tools of high-grade alloy steel, and handles of molded Celanese* plastic. Write for our 8-page booklet that fully describes the seven different Speed Tool Kits.

Obtainable at Suppliers throughout the country. If your Supplier does not carry these Kits, send his name to us, along with yours, and you will be taken care of promptly.

* Reg. U. S. Pat. Off.

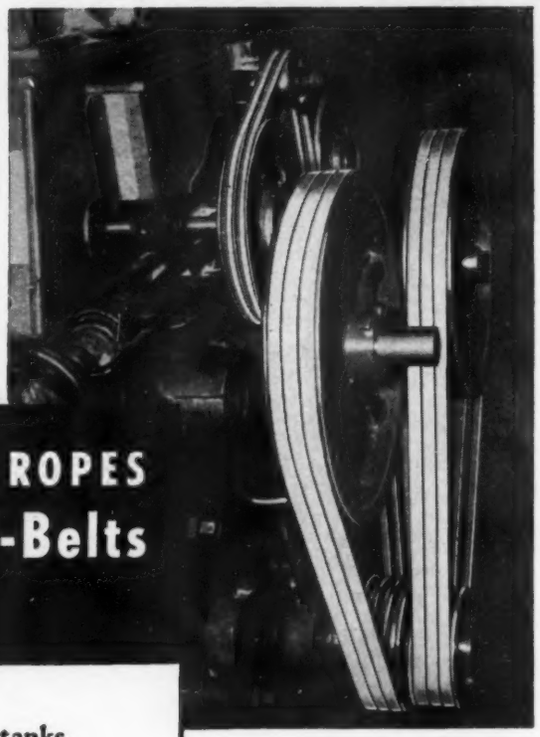
OVER 43 YEARS IN BUSINESS

KITS: Patents Pending

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

Here's an important fact



GATES *Standard* VULCO ROPES are TODAY *Outwearing* any V-Belts Ever Built Before!

The simple fact that during the war our Army's tanks, tractors and self-propelled big guns required V-belts of a strength and durability never thought possible before is bringing substantial benefits to Gates V-belt users today. That is because Gates developed these greatly superior V-belts for our combat units—and here is why this fact is now important to YOU:--

with this simple reason behind it

Every improvement developed by Gates for U. S. Combat Units— and many later improvements, also—have been added, day by day, to the quality of the Standard Gates Vulco Ropes which have been delivered to you.

As a result, *long before the war was over*, you were getting in your Standard Gates Vulco Ropes a product built to far higher service standards than any V-belts ever built by anyone before the war.

And the improvement by no means ended there. Through continuing *specialized* research, the service qualities of these superior Gates Vulco Ropes have been still further improved as all of Gates facilities and energies have been returned to the service of industry.

These are the simple reasons why the standard Gates Vulco Ropes you are getting today are delivering far better service than any V-belts ever built before!

THE GATES RUBBER COMPANY
DENVER, Colorado
World's Largest Makers of V-Belts

All Gates V-Belts are Built With *The Patented* CONCAVE SIDE

Gates
THE MARK OF SPECIALIZED RESEARCH

466

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks **IN ALL INDUSTRIAL CENTERS** of the U. S. and 71 Foreign Countries

Because dimensions are fixed

Alcoa Aluminum die-cast parts stay "on center"

These Alcoa Aluminum die castings form the body of these precision binoculars, product of Bausch & Lomb Optical Co., Rochester, N. Y.

Aluminum doesn't "grow" when exposed to moisture and elevated temperatures. Nor does it creep or sag under load. You'll appreciate these advantages where die castings are required to hold accurate dimensions for life.

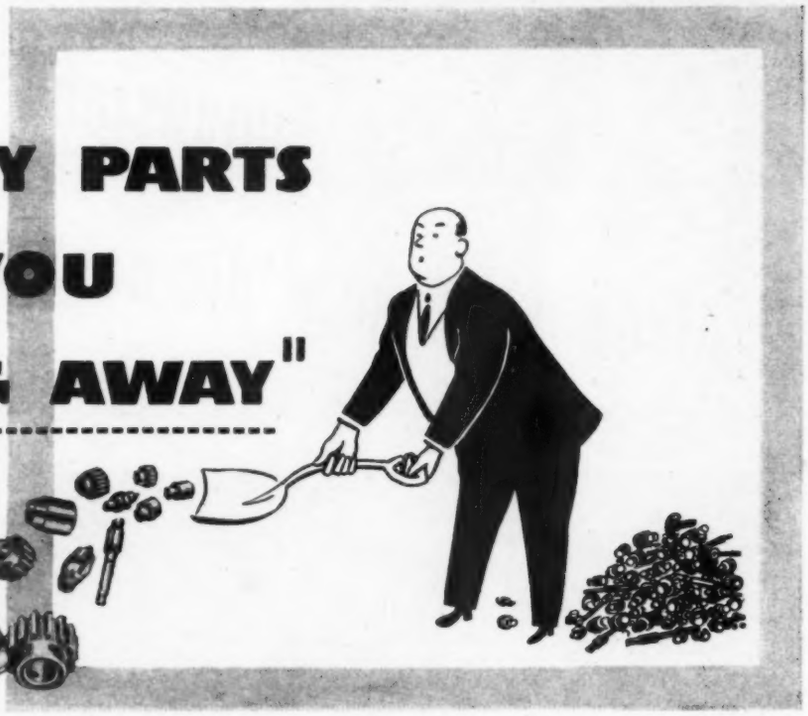
Because these parts are made of aluminum, the finished product is also light in weight, strong, durable, and fine in appearance.

When you've roughed out the design for a new product, talk with an Alcoa engineer. The more parts you can make as die castings, the more money you'll save on production. Call the nearby Alcoa office, or write:

ALUMINUM COMPANY OF AMERICA,
2107 Gulf Building, Pittsburgh 19, Pa.

ALCOA FIRST IN **ALUMINUM**

HOW MANY PARTS ARE YOU "THROWING AWAY"



SPEED CASE x1515

A LOW CARBON OPEN HEARTH PRODUCT

SPEED CASE x1515 Steel will materially reduce your rejections, now due to excessive warpage, bad finish, tool marks, etc.

The unusually high free machining qualities of SPEED CASE (250 S.F.P.M.) assure increased production with excellent finish of machined parts maintained. Distortion resulting from carburizing is reduced to a new low with SPEED CASE STEEL. Many plants report sufficient production increases, or savings on rejections, to pay for the steel.

Write for our Brochure which gives complete data and Case Histories furnished by our customers.

ACTUAL PHOTOGRAPH

Speed Case (.20 carbon) 1 inch cold drawn bar tied in a knot, without fracture.

Tear this off . . . ATTACH TO YOUR LETTERHEAD AND MAIL TO EITHER COMPANY BELOW

Licensor

MONARCH STEEL COMPANY

HAMMOND · INDIANAPOLIS · CHICAGO

PECKOVER'S LTD., Toronto, Canadian Distributor

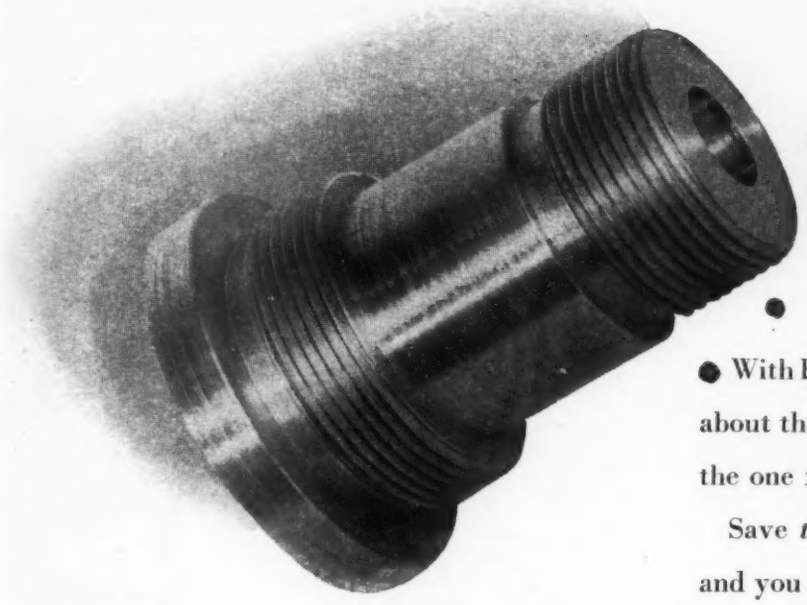
MANUFACTURERS OF A COMPLETE LINE OF COLD FINISHED CARBON AND ALLOY STEEL BARS

Licensee for Eastern States

THE FITZSIMONS COMPANY

YOUNGSTOWN, OHIO

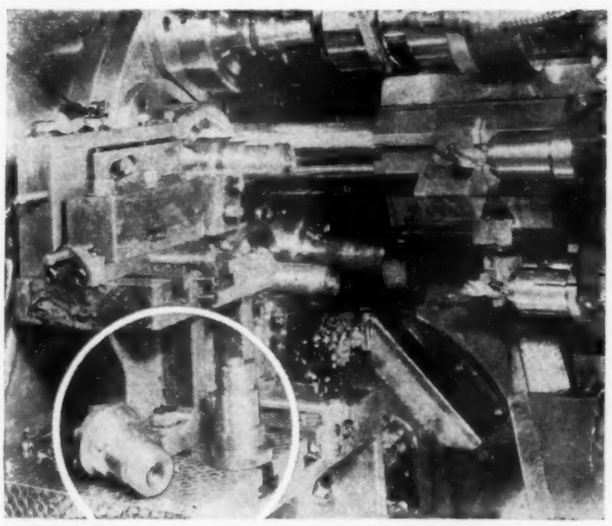
FASTER . . . . . -- less than 20 seconds!



● With basic material costs and basic wage rates about the same for you as for your competitors, the one factor you can control fully is *method*.

Save *time* by better methods of production and you reduce cost.

Take for example the steel sleeve shown above, 2½ x 3¼". The 16 operations on this part are done on a 2⅝" six spindle Acme-Gridley Bar Automatic in less than 20 seconds.



Heavy roughing cuts and fine finishing produce consistently high accuracy in this fast time. Two Vers-O-Tools with ground thread circular chasers were used for the threading.

Feel free to ask us for Acme-Gridley time estimates on any precision parts you turn out in quantities — on either bar or chucking equipment.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

COLLETS AND PUSHERS
The design, materials and methods of processing GENUINE Acme-Gridley Collets and Pushers are vital to continuous low-cost performance on your Multiple Spindle Automatics.
Bulletin CP-45

Capacity . . .

MARVEL 18 *for Size,* MARVEL 6A and 9A *for Volume Production*

With this battery of twelve No. 6A and No. 9A MARVEL High Speed Automatic Hack Saws, the Hammond & Irving Forge Co. of Albany, New York can cut-off billets automatically, not only in tremendous numbers, but in accurate weights and sizes to exactly fill each die without waste. With 12 of the "world's fastest cutting-off saws", they were able to keep all hammers running on their tremendous war orders, and were able to instantly resume peacetime manufacturing without re-tooling or other delay. The No. 6A and No. 9A MARVEL automatics have capacities of 6" x 6" and 10" x 10" respectively.

In addition to the battery of MARVEL Automatics, Hammond & Irving have cutting-off *capacity* of a different sort in their MARVEL No. 18 Hydraulic Hack Saw—capacity for size because this roll stroke giant cuts off billets and bars in 18" x 18". It easily handles the toughest and hardest steels.

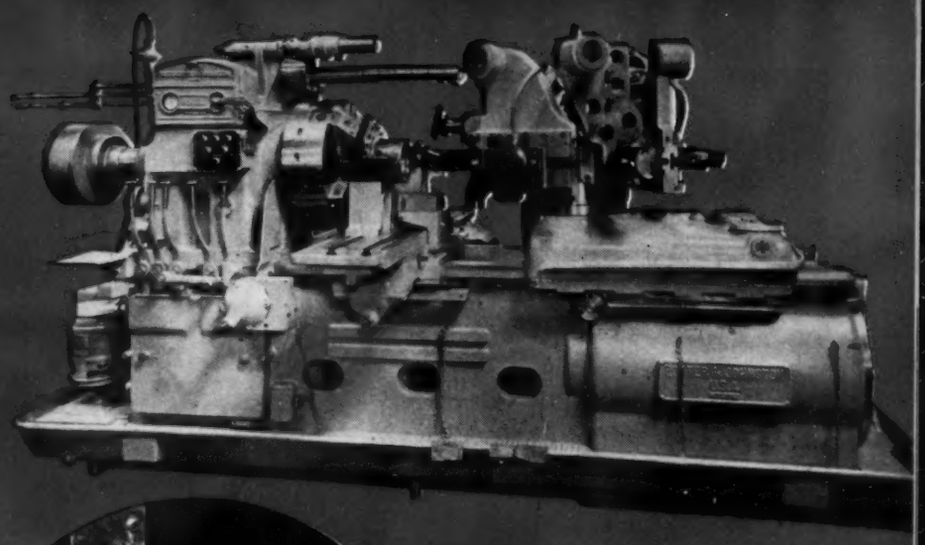
ARMSTRONG-BLUM MFG. CO.

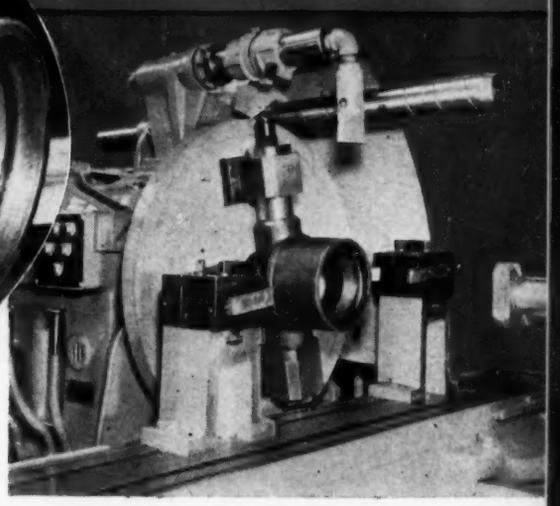
"The Hack Saw People"

5700 BLOOMINGDALE AVENUE CHICAGO 39, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.

An Example of the TOOLING FLEXIBILITY Available to METHODS ENGINEERS on the P&J 6 DREL AUTOMATIC





DETAILS OF OPERATIONS

Part: Terminal

Material: Steel Forging

Hardness: 276 Brinnel

Method: Presenting cross hole end to spindle; grip on OD of flange with 2 Jaws: position against stop pin at cross hole hub.

Machine as follows:

1st. T.F. . . Rough bore 5.567" dia. to bottom: square up bottom: bore 6¾" dia. approx. ⅞" deep: rough turn and face thread dia.: rough face shoulder.

2nd. T.F. . . Remove surplus stock from bore rear of pinion bosses: single point with Slide Tool: bore 6¾" dia. x ⅞" deep.

3rd. T.F. . . Semi finish thread dia.: face end and shoulder: bore 5.567" 6¾" dia.

4th. T.F. . . Bore undercut 6⅝" dia.: (Slide Tool)

5th. T.F. . . Finish bore 5.567" dia. (for locating purpose only)

6th. T.F. . . Form 6⅝"-6¾" dia.: form radii (Slide Tool).

Subjects rough machined and heat treated (400 Brinnel) before coming to this operation: Presenting cross hole end to spindle, place subject in fixture, locating on plug in reamed cross hole dia.: Position with bar in turret and hold in place with clamp nut and washer on top side.

Machine as follows:

1st. T.F. . . Positioning bar

2nd. T.F. . . Semi finish turn and face shoulder and thread dia.: bore 6¾" dia. approx. ⅞" deep: bore 5.567" dia.

3rd. T.F. . . Blank

4th. T.F. . . Finish surfaces as machined on 2nd. T.F.

5th. T.F. . . Blank

6th. T.F. . . Size bore 5.567" dia.

●

P&J Engineers are available to apply their long and varied experience in tooling to meet your specific production requirements.

Ask them for assistance.

POTTER & JOHNSTON MACHINE COMPANY

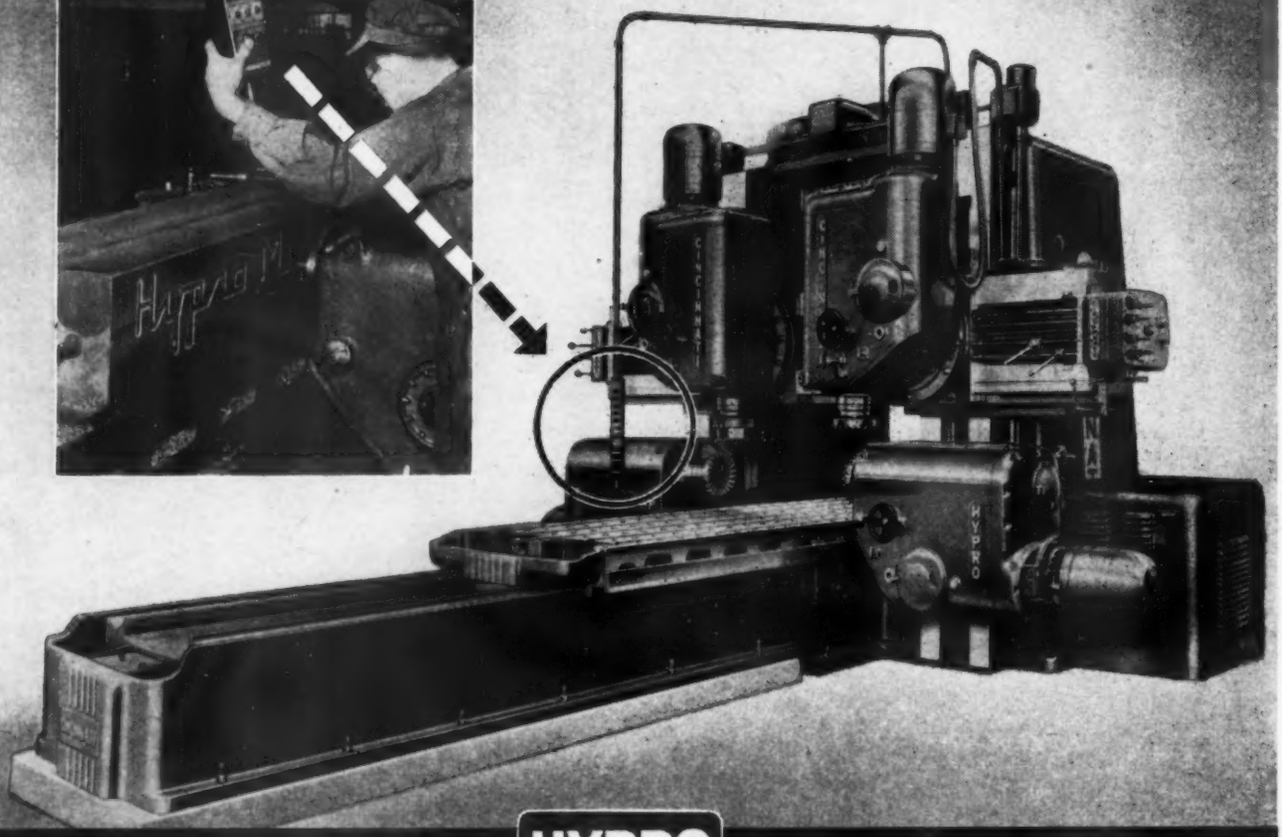
PAWTUCKET, RHODE ISLAND

NOW COMPLETE FINGER-TIP CONTROL FROM PENDANT STATION...

Hypro·electronic

PLANER MILLER DRIVE

Photo on left shows operator milling the words Hypro Miller in cast-iron block — an unusual demonstration of the versatility and absolute control of any head or table from pendant station exclusively.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

874 C-10 . . . another *"PLUS-PRODUCTION"* MARATHON *Lubricant*

Cut down "burn rejects" on precision gears . . . switch to MARATHON 874 C-10 Gear Grinding Oil

HERE'S A GRINDING OIL powerful enough to take it under the high temperatures generated in precision gear grinding. Yes, and powerful enough to keep on taking it so that you don't have momentary failures that result in burned spots, burned gears or soft areas in the gear tooth caused by overheating. Transparent, non-foaming, Marathon 874 C-10 prevents smoke, does not corrode or stain the work piece, has no objectionable odor, will not turn rancid, does not injure workmen's hands.

More than a one-purpose oil, Marathon 874 C-10 has many applications in turning, milling, tapping and deep drilling. An Ohio Oil lubrication engineer will be glad to point out the advantages of this powerful cutting fluid in your operations. Just write, wire or phone.

A COMPLETE LINE OF CUTTING AND GRINDING OILS FOR EVERY METAL WORKING OPERATION

THE OHIO OIL COMPANY

GENERAL OFFICES: FINDLAY, OHIO

District Offices: Robinson, Ill., Indianapolis, Ind., Louisville, Ky.

MARATHON

PRODUCERS OF PETROLEUM SINCE 1887

Retract and Reposition Your Work

within .0002" Selected Location

by Push Button Controls!

3-B DEVLIEG JIGMIL Provides for

Minimum Tool Overhang

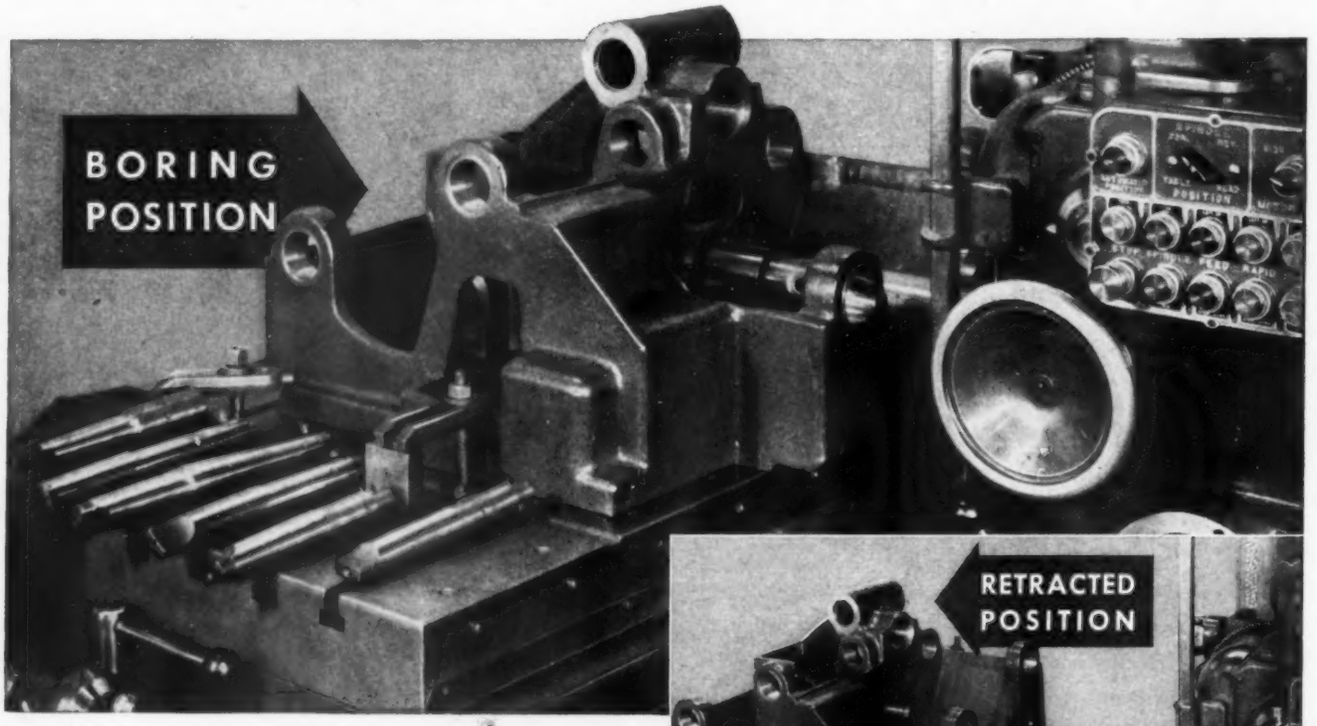
Maximum Operating Efficiency

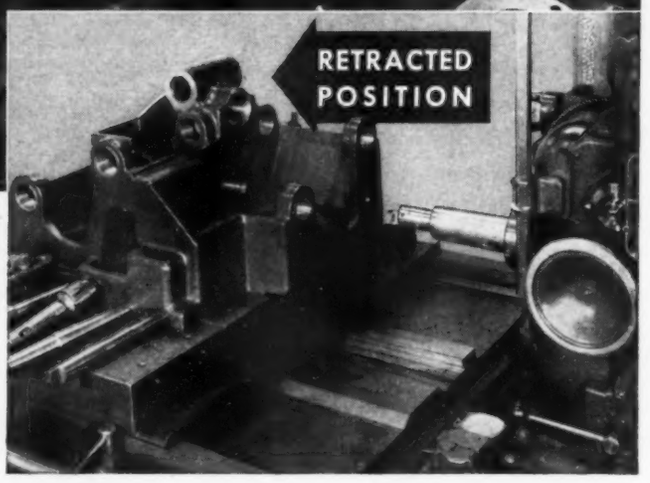
Greater *Controlled* Accuracy

You can save time, cut costs and reach new high standards of accuracy on your difficult precision jig boring and milling operations with a 3-B DeVlieg JIGMIL.

Location of work for minimum tool overhang and top performance advantage! Ready accessibility for necessary tool adjustments and changes! Convenience for checking machined dimensions! All these are served by JIGMIL's centralized push button control means which unlocks and retracts the table to open position, then automatically repositions and locks the table to within .0002" of the selected position.

In addition, JIGMIL's push button controls provide automatic hole spacing accuracy within .0001". Write today for complete descriptive and technical literature.



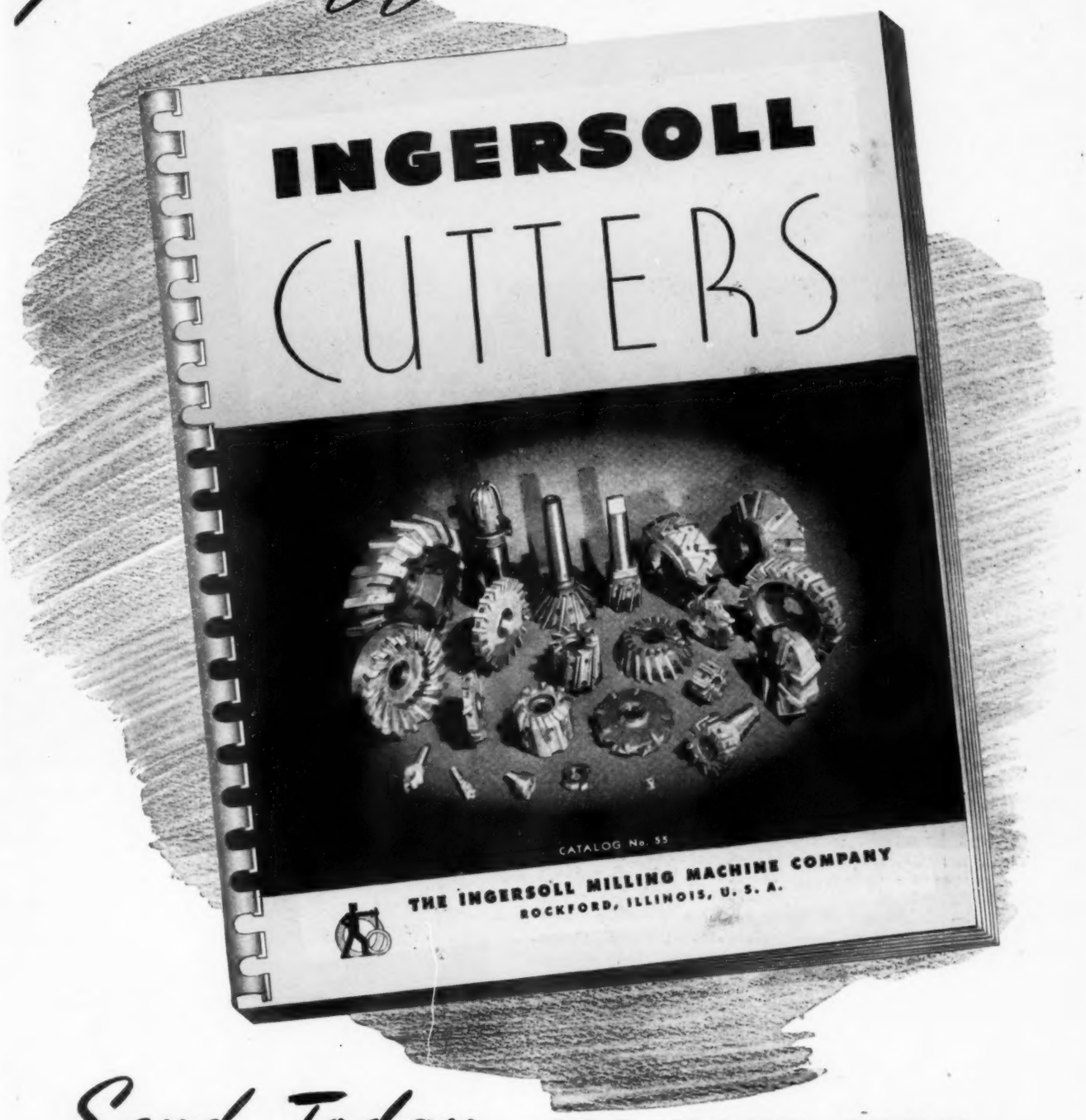


Here's Precision Boring at its Best!

The work piece above is an intricate casting for a three way diamond boring machine. All holes were bored on a 3-B DeVlieg JIGMIL to size, length and spacing accuracies of within .0001". Of the five castings comprising this particular job, the same high JIGMIL standard of accuracy was maintained throughout for perfect interchangeability of parts!

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

Just Off the Press!



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THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILL.

Builders of Inserted Blade Milling and Boring Tools

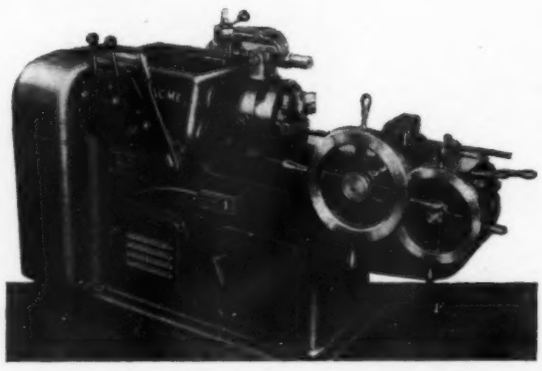
Comparators Never Lie

64 time enlargement of a 1" U. S. Standard thread with 8 threads to the inch.

Your own comparator or similar measuring device will *prove* that ACME XL Threading Machines using the ACME Tangent or Hob type die head, produce threaded bolts to class three specifications. The extreme rigidity of all sizes of ACME XL machines is an important factor in obtaining this accuracy.

Add to this accuracy the versatility of ACME XL Threading Machines (10 different uses) and you have a profit making piece of equipment for any type of machine shop.

ACME XL Threading Machines are built in capacities from 1 to 3 inches and in single or double spindle models.



THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **4535 St. Clair Ave. Cleveland 14, Ohio**

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FORGING · THREADING · TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" HYDRAULIC SURFACE GRINDERS
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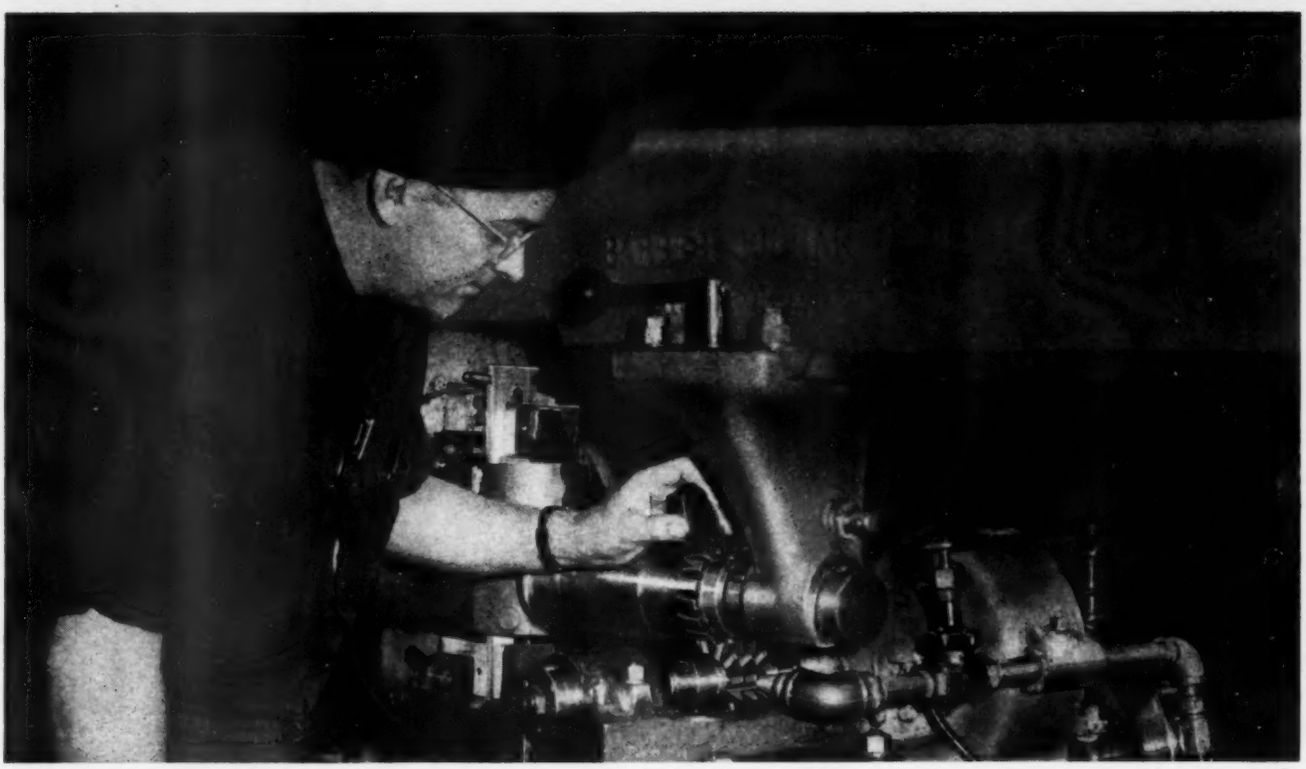
BARBER-COLMAN

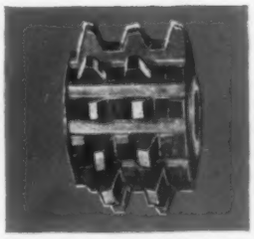
HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS



PRODUCTION SPLINE-HOBBING WITH HIGH ACCURACY IN TOUGH MATERIAL ON TYPE "A" HOBBING MACHINE

PIECE. This aircraft landing gear strut is made of SAE4130 steel heat-treated to Rockwell C 36-41 before hobbing.

Here is an excellent example of how the Barber-Colman Type "A" Hobbing Machine can be depended on to deliver good production on a job with many difficult conditions. The material is tough, hardened steel and the splines must be cut accurately as to both position and size. The sides of the splines are straight and parallel, and excellent finish is demanded. Hobbing, particularly on the rugged, accurate Type "A" Machine, is ideal for work of this type because precision index is inherent to the machine and precision form-cutting is inherent to the hob. With this combination, set-up difficulties common to other types of machining are avoided and greater production efficiency is achieved. *Use Barber-Colman Hobbing Machines where accuracy and production are required.*



TYPE OF HOB USED

B-C elongated-tooth type of hob is used to generate straight and parallel sides on the keys, with minimum radii at the root corners.

JOB FACTS

DIMENSIONS. Sixteen splines, 1-25/64" long, 3.742/3.743" O.D., 3.180/3.171" root dia., .360/361" key width — equally spaced with center line groove on center line of strut within 5 minutes. Keys checked to ±.0005" with GO-NO GO gage.

MACHINE SET-UP. Feed .035" per revolution of work, hob speed 40 r.p.m. Work held between centers with special driver.

PRODUCTION. Using two machines, 32-35 pieces per 8-hour day. Hob delivers 10-13 pieces per sharpening.

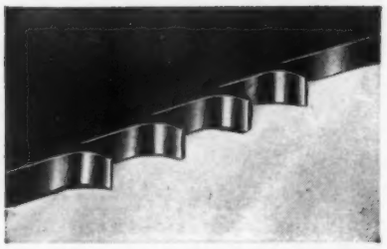
BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

ARMSTRONG

SYSTEM OF TOOL HOLDERS



As each chip is comparatively light, a planer will, with this tool, carry with ease a feed and depth of cut much greater than is possible when using an ordinary tool, and there is much less tendency to "break out" at the end of cut.

DOUBLES (even triples) PLANER PRODUCTION

The ARMSTRONG Gang Planer Tool not only ends costly delays for "tooling-up", it actually reduces planing time as much as 75%—multiplying machining profits proportionally. It is the correct tool for planing large surfaces. Carrying 4 square cutter bits, this tool makes not one but four cuts with each traverse of the bed. The head of this tool swivels and is graduated so that it can be quickly and accurately set to any desired feed.

The Armstrong System of Tool Holders provides the correct tools for every operation on lathes, planers, slotters and shapers. Each is an efficient profit-building tool — a permanent multi-purpose ARMSTRONG TOOL HOLDER that "Saves: All Forging, 70% Grinding and 90% High Speed Steel". Your industrial distributor has them in stock.

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"The Tool Holder People"

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Get ALL the advantages of magnetic holding

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COST NOTHING TO OPERATE . . . EVEN TO INSTALL

★No electricity, wires, electrical connections, generators or brushes.

★Nothing to maintain. Special alloy magnets retain energy indefinitely.

SAFE FOR WORKMAN AND WORK

★No danger of work flying off due to power interruption.

★Work can be left on chuck indefinitely without danger of heating either chuck or work.

SIMPLE MECHANICAL CONTROLS

★Hand-operated. Easy 180° movement from ON to OFF position.

★POSITIVE HOLDING

★INSTANT RELEASE

★plus wide variations of holding force for easy positioning of work.

MORE USEFUL IN MORE PLACES

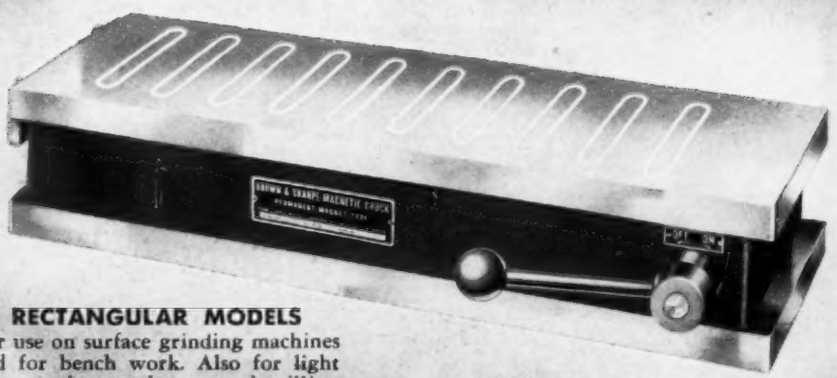
★Portable . . . for use on various machines, also for testing, inspection and laying out work.

★Wet or dry grinding.

★Large, heavy work or groups of small parts.

★These chucks are for sale only in the United States of America and its Territories.

ROTARY MODEL
for grinding operations and light cuts on lathes.



RECTANGULAR MODELS
For use on surface grinding machines and for bench work. Also for light cuts on planers, shapers and milling machines.

ALSO permanent magnet V blocks and dial test indicators with magnetic bases.

WRITE FOR CATALOG describing operating principles.

BROWN & SHARPE MFG. CO., Providence 1, R. I.

BROWN & SHARPE

COLLETS

Guaranteed *

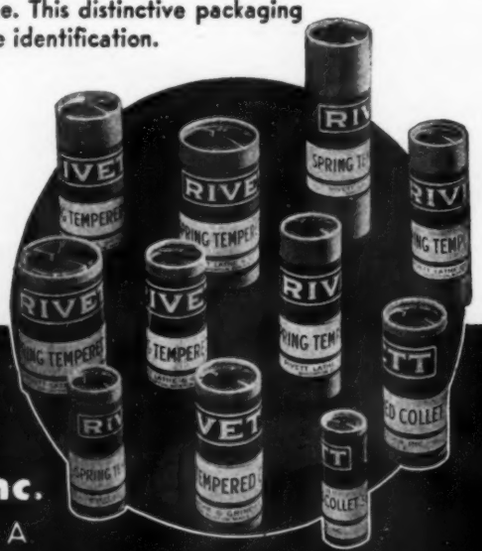
TO RUN DEAD TRUE

Work held in a Rivett Collet is guaranteed to run "dead true" at the Collet mouth and within .002" two inches from the Collet mouth. Rivett Draw-In Collets are available in all standard styles for bench lathe, engine lathe, miller and grinder use.

They have personality derived from a worthy inheritance and a steadily improved environment. When shipped, each Rivett Collet reflects more than fifty years of Collet manufacturing "know-how" and the most advanced machining and inspection.

See how the individual cartons permit you to read easily through the "window" the style, size and Rivett name. This distinctive packaging provides protective storage with absolute identification.

* For complete information on all Rivett Collets and their adaptation to existing machines write for Bulletin 100C.



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BULLETIN NO. 100C

NOTHING LIKE BEING PREPARED!

Even a carefree youngster knows the value of preparedness! Then surely a production-minded shopman should at all times be prepared for emergencies.

You never can tell when a milling machine arbor might suddenly break down, causing vital production schedules to be disrupted and machine hours wasted. So be prepared! Keep several spare arbors on hand for emergencies. Remember, arbors are classed as "perishable tools" and their cost today is relatively small.

Kempsmith Arbors in all popular sizes and types are regularly carried in stock. Every one is a precision-built tool, adaptable to ANY make of milling machine equipped with standardized spindle. Fill in and mail coupon for bulletin.

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Kempsmith Arbors are backed by more than a half century of specialized experience in designing and producing rugged milling machines and accessories.

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KEMPSMITH — Yes, I would like to receive a copy of your new Arbor Bulletin:

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A 4703-1P-C

THE JOB Stainless steel is difficult to mill under almost any circumstances — but this super-powered CSM, equipped with the proper cutter, literally "walked through" this job.

OPERATION:	Rough Mill Stud	DEPTH OF CUT:	.441" (Max.)
MATERIAL:	Stainless Steel	SURFACE SPEED:	346 SFM
CUTTER:	6" Dia.; 8 Tooth	FEED PER TOOTH:	.020"
TABLE FEED:	21 IPM	MILLING TIME:	26 Seconds

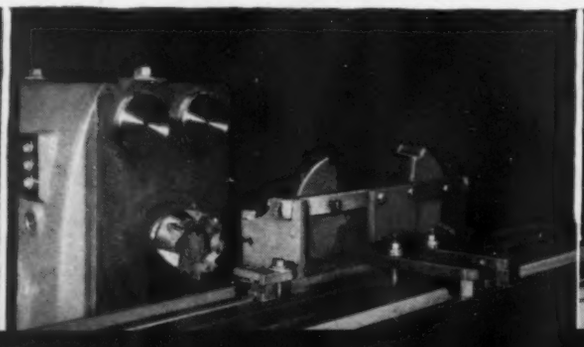
THE PART

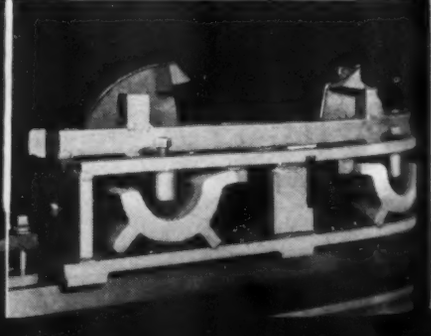
Note the excellent finish obtained despite the high rate of metal removal. The milling time of 26 seconds includes both surfaces. Micrometer stop dial indicator on machine facilitated this step milling operation.

MORE EXAMPLES OF CSM PERFORMANCE

Operation: Rough mill angle on knee gib support—with 34% time reduction. Material: C. I.—Speed: 336 sfm—Cutter: 3" dia., 8 T.—Feed per tooth .010"—Depth of Cut: 5/32". Previous Milling time: 61 seconds — CSM Milling time: 45 seconds.

Two views of set up for milling socket arm part with 65% milling time reduction. Center sho
rear of special holding fixture in place on machine table. At right, machined surfaces of pa
Material: Cast Steel—Surface Speed: 346 sfm—Cutter: 6" dia., 8 Tooth—Feed per tooth: .0
—Depth of cut ¼". Previous milling time: 4 min. 52 seconds—CSM milling time: 1 min. 42 se





STAINLESS STEEL MILLING

made easy on a

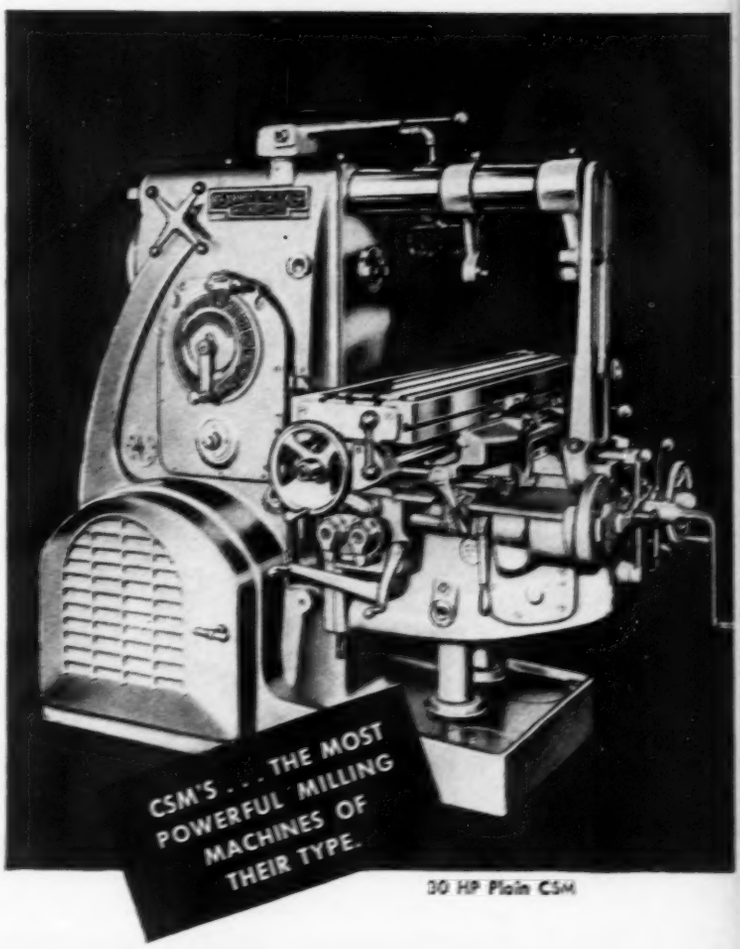
KEARNEY & TRECKER CSM

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been stabilized after complete analysis of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards and will cut metals faster and to finer tolerances and superior finishes than ever before — with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.



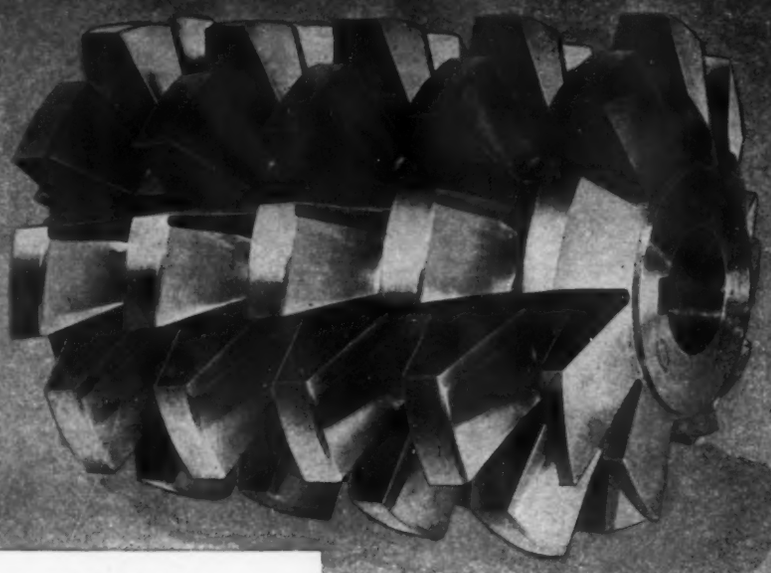
30 HP Plain CSM

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

"Be ready for tomorrow with **CSM's**"

HOBS
of many
kinds
for many needs
where precision
and durability
are required



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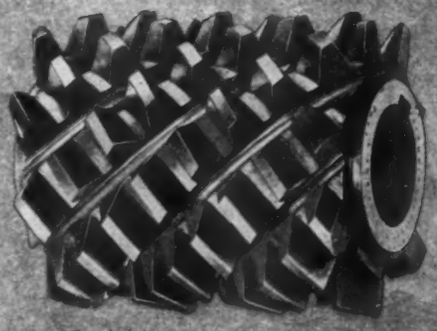
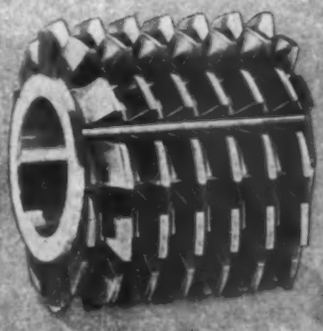
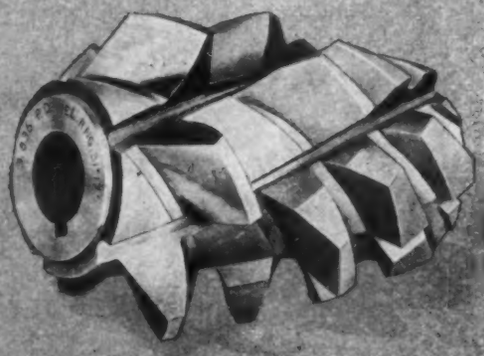
NATIONAL Tools CLEVELAND

Cutting Tools
for
All Purposes







Herringbone Cutters,
Broaches, Gear Cutters,
Gear Shaper Cutters,
Circular and Flat
Form Tools,
Form Relieved Cutters,
ground and unground;
Hobs,
ground and unground;
Milling Cutters,
Special Tools

NATIONAL TOOL Co.
11200 MADISON AVE
NATIONAL Tools CLEVELAND
CLEVELAND, OHIO

SPECIFY *Van Keuren*

WIRE TYPE PLUG GAGES

Tool Steel
High Speed Steel
Chromium Plated
Carboloy

SET NO. 80

Wire Type Plug Gage Set No. 60. This set of gages provides accurate standards for checking twist drills in sizes from 1 to 60 (.228" to .040" diameter.) A useful set of standard size gages. Price $375.00

Van Keuren Wire Type Plug Gages Set No. 80 which includes drill sizes from No. 1 to 80 (.228" to .0135.) Price $425.00

The 160-page Van Keuren Catalog No. 33 gives full information on wire type plug gages and other precision measuring equipment. It also includes simplified formulas for measuring threads, splines, gears and worms. Your copy of this valuable handbook will be sent on request.

Wire Type Plug Gages were originated by the Van Keuren Co. in 1925. They are now in almost universal use for gaging small holes.

Longer lasting precision and lower gage cost are assured because the entire 2" length of the gaging unit can be used. When the end becomes worn, it is ground off and a new section of the original accuracy is moved out for use. The wire unit is securely held in the handle by a split bushing and a headless set screw.

Van Keuren Wire Type Gages are made to Class B accuracy +.00005" −.00000" on the Go units and ±.000025" on the No Go units. Closer or wider tolerances can be supplied if desired.

On your next order specify VK Wire Type Plug Gages. VK Carboloy for long runs because of the enormous saving in gage cost. VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits. VK Tool Steel—High Speed—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

THE *Van Keuren* CO., 176 WALTHAM STREET, WATERTOWN, MASS.

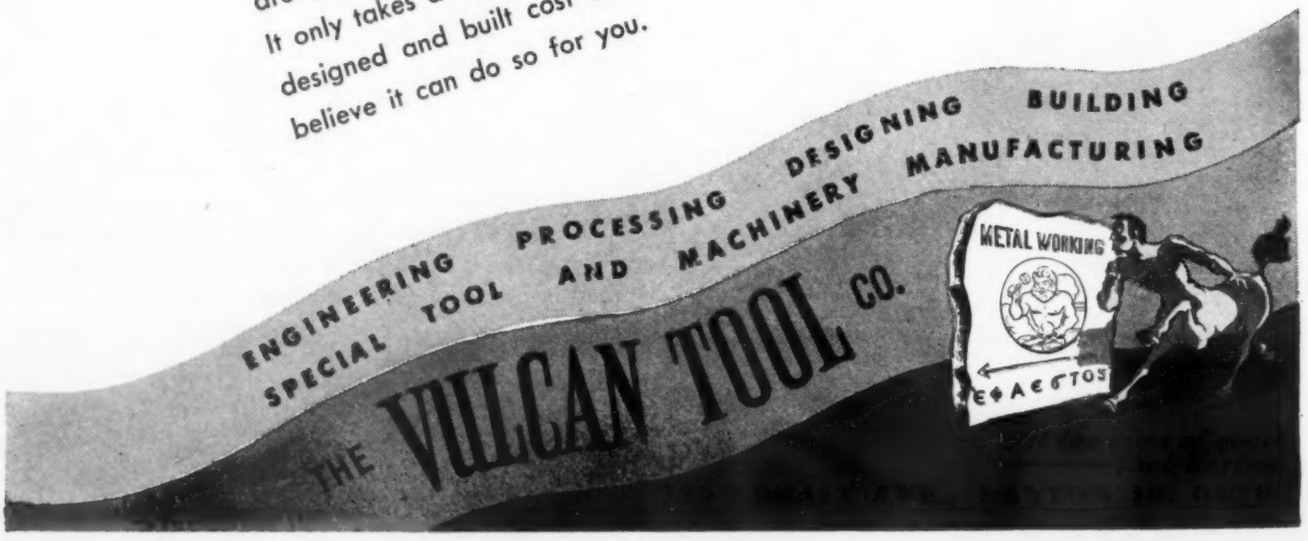
27th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.

CROWNS STILL WEAR LIONS BUT LIONS WEAR CROWNS NO MORE

Hunted man now hunts the lion with tools. With tools man makes his voice heard a thousand times as far as the lion's. With tools General Marshall jumped from Chungking to America—a leap a million times as far as any lion ever sprang.

Tomorrow the crown in your industry will be worn by the firm that is now acquiring better special tools, and multiplying by ten, or a hundred, or a thousand times the work that one man has been doing. It only takes a little time and a little faith to consult a firm that has designed and built cost cutting special tools for others and dares believe it can do so for you.



Fast accurate production with Newton Milling Machines specially designed for your milling jobs

NEWTON HEAVY DUTY 48" VERTICAL ROTARY MILLING MACHINE

This machine is just one example of the many types of Newton Milling Machines designed and built by Consolidated to bring about new production economies. The arrangement shown here has two spindles for rough and finish milling of front and rear faces of fly wheel housings. It can also be furnished with three and four spindle heads, and with support for spindle head in center of table. Regularly equipped with 25 H. P. motor.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

Consolidated engineers are always at your service to help in the solution of your difficult milling problems. Send us your inquiries. They will receive immediate and full attention.

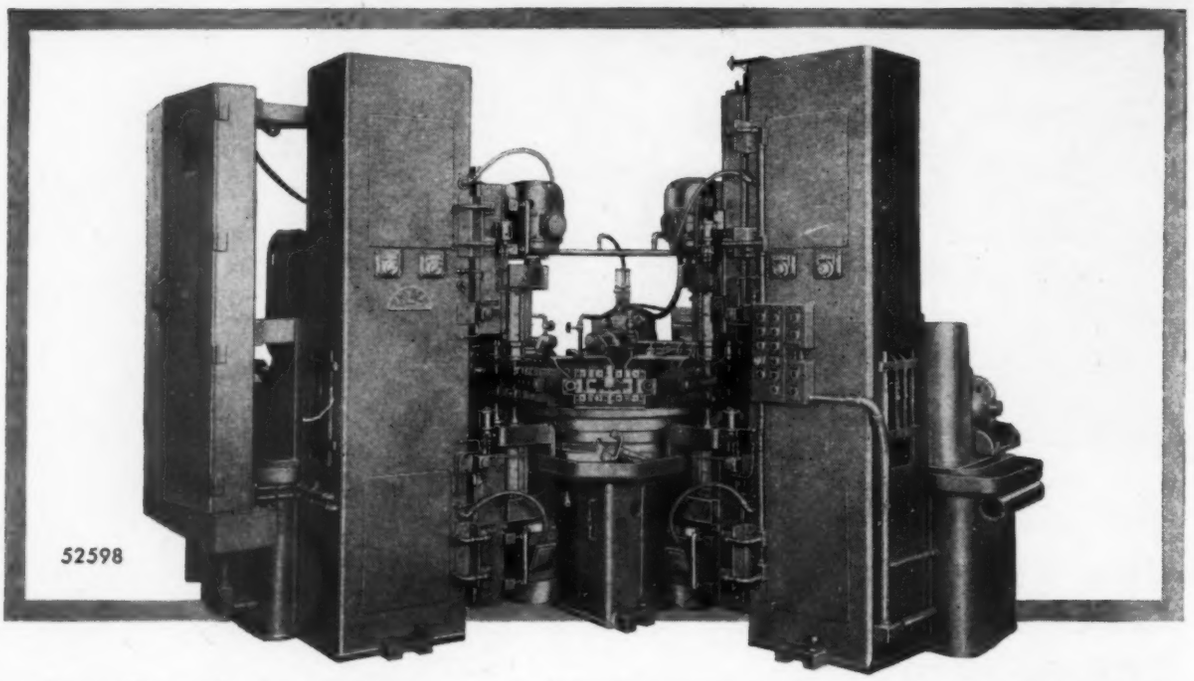
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

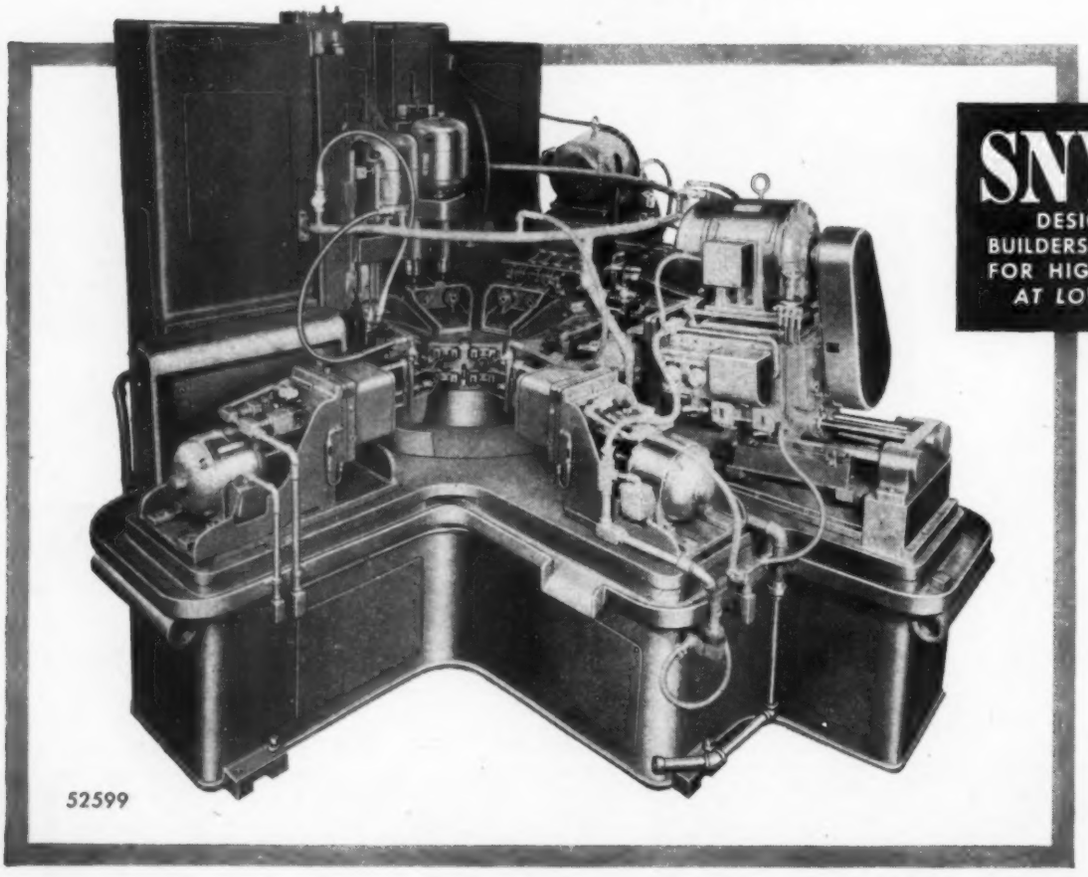


7-STATION *Snyder* SPECIAL for PROCESSING STEERING KNUCKLES

Designed and built by Snyder specifically for processing automotive steering knuckles, this special-purpose machine has an estimated production of more than 100 cycles an hour, or, over 200 parts, at 80% efficiency.

Each fixture on the seven stations clamps two parts—one left and one right. The operations performed are drilling, reaming, tapping and two-way rough and finish boring, these operations being performed by a series of units arranged around an automatically operated index table.

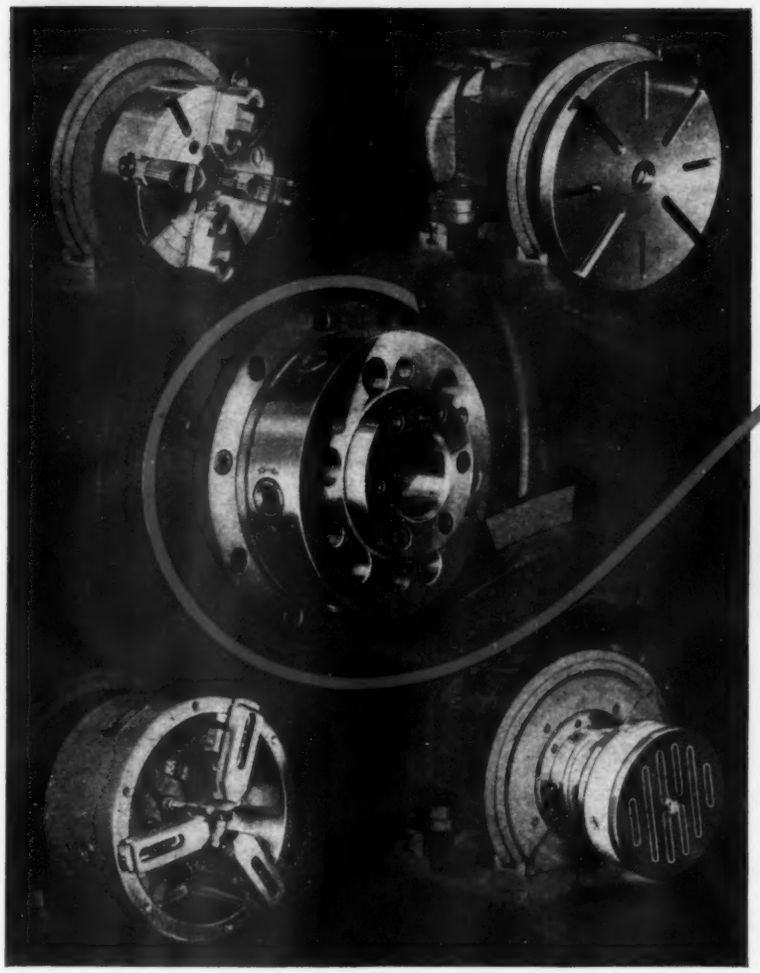
The automatic operation, reduction in handling and in operator fatigue, control of accuracy, finish and time cycle are typical of the advantages in Snyder special-purpose machines. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*

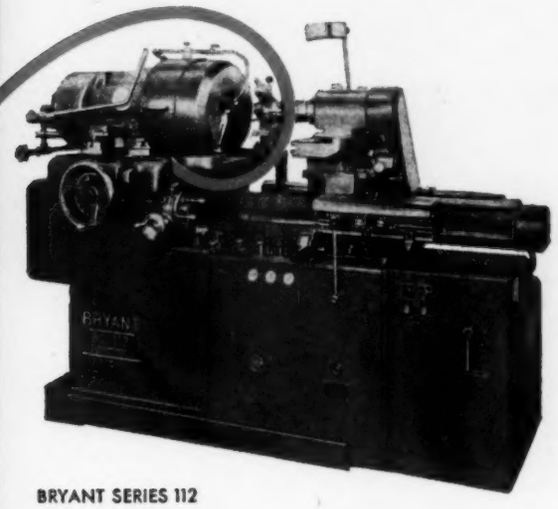


SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries





BRYANT SERIES 112

CAM LOCK

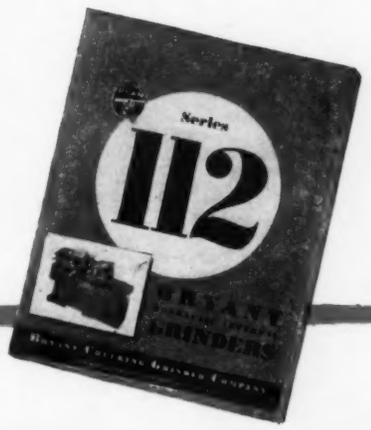
FOR INTERNAL GRINDING

● **MINIMIZES SETUP TIME ON TOOL ROOM WORK**

Holding fixture changes in less than 2 minutes? . . . You can on the Bryant Series 112 Hydraulic Internal Grinder. This modern tool room grinder is equipped with an American Standard Spindle Nose with the quick-change cam lock feature. This means that (a) Accurate centering is provided by the tapered pilot on the spindle nose fitting into a tapered recess in the back of the chuck, (b) Squareness of mounting is obtained by the ground face in the back of the chuck registering against the ground face of the spindle nose, (c) The chuck is held rigidly in position by the locking cams in the spindle nose which engage the cam locking studs in the back of the chuck, and (d) The cam lock feature also provides a quick means of mounting and unmounting the chuck. A clockwise, one-quarter turn of the wrench on each locking cam is sufficient to lock the chuck securely.

You will find important tool room features like this at every point of the Bryant Series 112 machines. It all adds up to less down time, more accurate work, finer work finish and fast production.

For complete details — Send for the Man from Bryant.

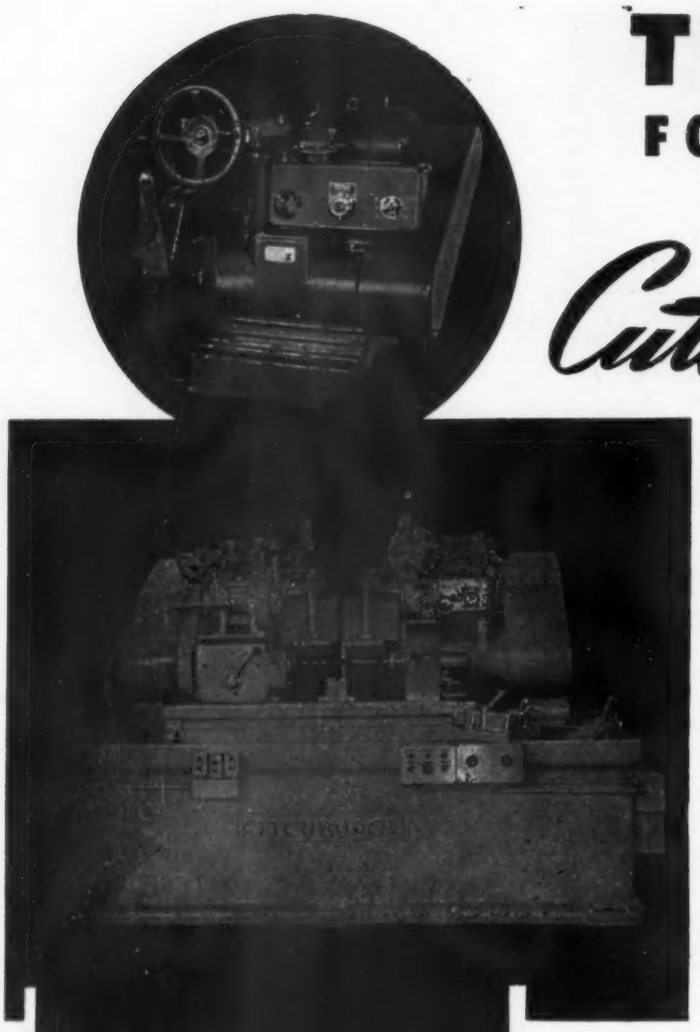


Write for big new catalog which describes this machine in detail

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



THIS HEAD FOR MULTIPLE PRECISION GRINDING *Cuts* PRODUCTION COSTS

Mass production can be applied to precision grinding only with equipment whose design incorporates simple, automatic precision controls. The Fitchburg method works on a new principle, far superior to other methods.

"Brain center" of multiple precision grinding, the Fitchburg Bowgage Head is a completely self-contained and independent grinding unit. It can be installed *singly* on standard equipment in any position and at any angle 0° to 90°, or in multiples to operate simultaneously or consecutively in mass production.

Fitchburg design gives greater accuracy, finer finish, speedier operation, at less cost per piece. See *how* Fitchburg Bowgage heads, standard and interchangeable, save your investment for the reconversion period. Write today for information on how its cut-cost features can be applied to the precision grinding jobs in your plant.

THE HEAD. *The Bowgage Head* is a completely independent precision grinding unit. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position — all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed.

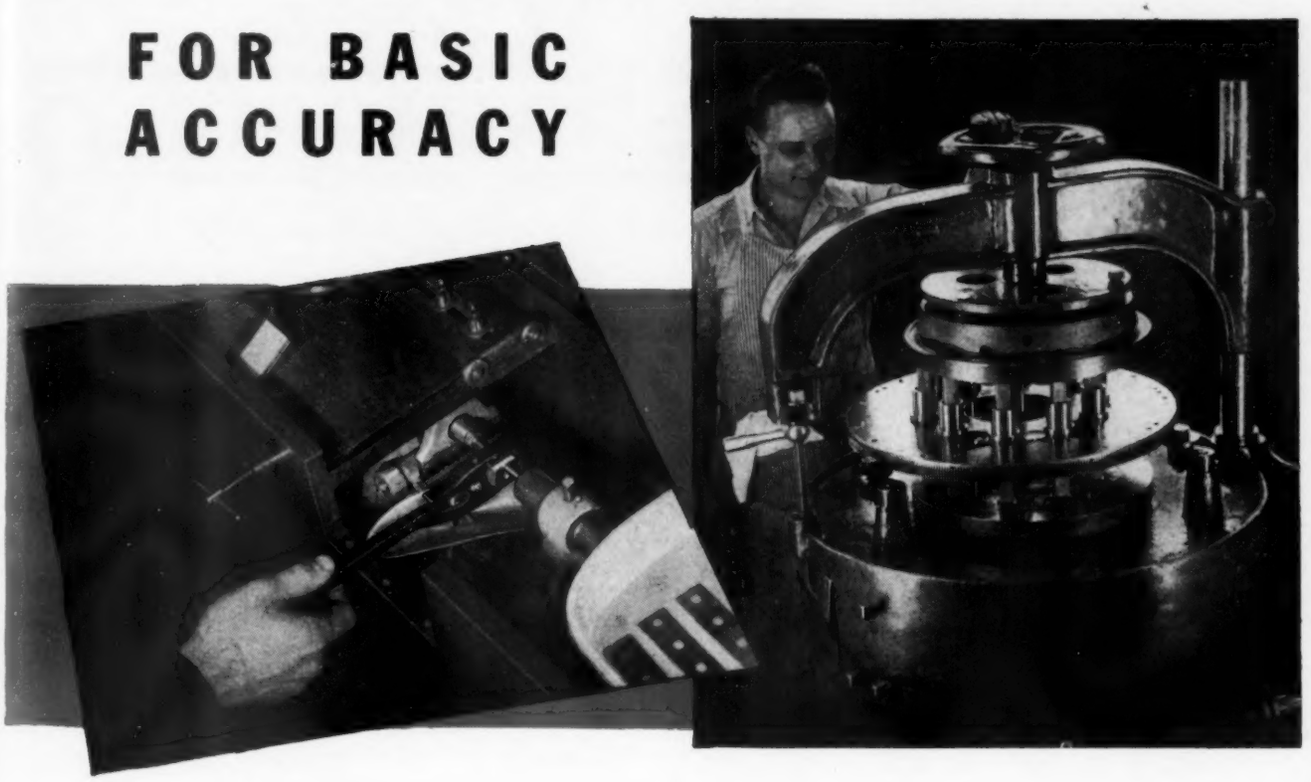
THE BODY. *This Special Fitchburg Double-Head Machine* grinds track roller shafts for caterpillar-type tractors. Two grinding wheels plunge-cut the diameter, after which both wheels travel toward each other to grind the shoulder of the shaft — *all in one set-up — with standard Bowgage Heads.*

Write Today for Catalog—Sent Free Upon Request

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U.S.A.
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders.

Double Check V V

FOR BASIC ACCURACY



Constant use affects the accuracy of any precision gage blocks — even Pratt & Whitney Hoke and USA blocks. Your gage blocks may be worn from constant use and handling and they may no longer retain their initial accuracy.

When you send your gage blocks, regardless of make, to Pratt & Whitney to be checked, they are inspected in our standards room at 68° by this procedure:

- Blocks are washed and cleaned.
- Blocks are inspected visually by a magnifying glass to detect burs and bruises.
- Large bruises and nicks are removed with a hand stone.
- Both sides of each block are hand rubbed on a large stone to remove smaller burs.
- Both sides are then plate lapped to smooth both surfaces before measuring.
- Blocks are measured in millionths comparator.
- A Certificate of Inspection is prepared, showing actual reading in millionths, for each block.

For this inspection service, only a nominal charge is made and recommendations for replacement of undersized (more than 15 millionths) blocks are made at the quoted prices.

Contact your nearest Pratt & Whitney Branch Office for packing and shipping instructions or send them direct to our factory.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

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Birmingham; Boston; Chicago; Cincinnati; Cleveland; Detroit; Los Angeles; New York; Philadelphia; Pittsburgh; Rochester; St. Louis; San Francisco

Choose

SPRINGFIELD

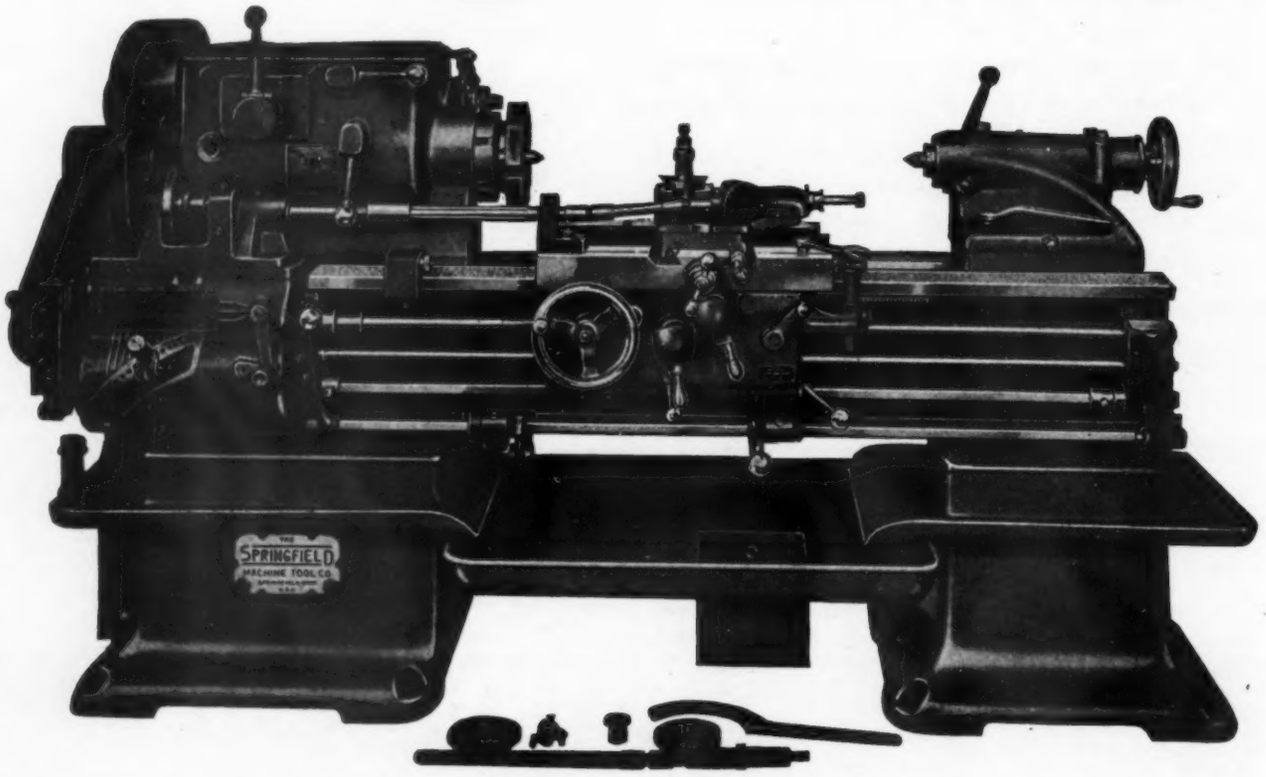
GEARED HEAD LATHES

"from the ground up"
a superior lathe!

All heavy castings in SPRINGFIELD Lathes, including the bed, are cast in our own foundry. Gearing is carefully engineered to deliver maximum efficiency for years. Attachments, many of which we feel demonstrate unusual engineering ingenuity, are designed for practical usefulness. Lubricating and power transmission systems are rugged, trouble-free. Check the records of SPRINGFIELD Lathes in other shops—then judge their capabilities and quality for yourself.

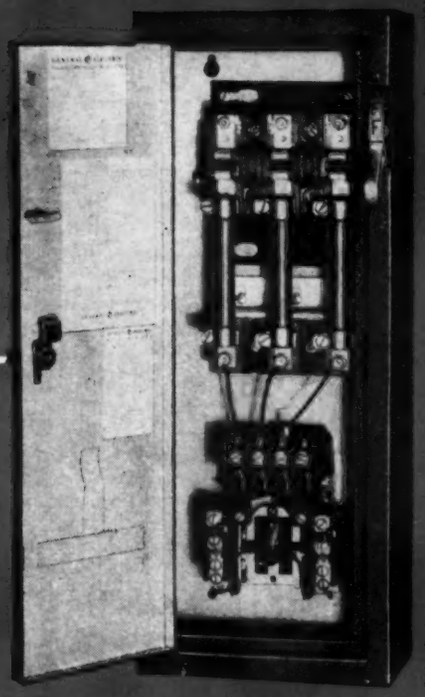
Get complete information—write for our new bulletins.

THE SPRINGFIELD MACHINE TOOL COMPANY
Springfield, Ohio



THE SPRINGFIELD MACHINE TOOL COMPANY

300 G-E COMBINATION MOTOR STARTERS...



...give White Motor Company real protection...save time, money, too.

Magnetic starter and motor-circuit switch in *one* unit—G-E "combination" motor starters of this type give co-ordinated control to over 300 machines in the White Motor Company plant in Cleveland.

The starter shown above is installed on a lathe used in making water pumps. Others control drill presses, shapers, boring mills, grinders, and many other types of machines.

Here's Why the Combination Starter Was Chosen

- Fast-acting overload relays protect the motor controlled from overheating—and fuses protect it from damaging short circuits.
- Safety for operators is assured by interlocking doors. While the power is on, the door cannot be opened.
- Quick servicing and availability of repair parts is made possible by G.E.'s broad network of sales outlets.

Wide Field of Application

This motor company represents just one of the many different industries in which G-E combination starters are at work today. Why not give the advantages of these compact, time-saving starters to *your* plant. Our engineers will be glad to help with your application. Get in touch with our local office today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

676-200-8910

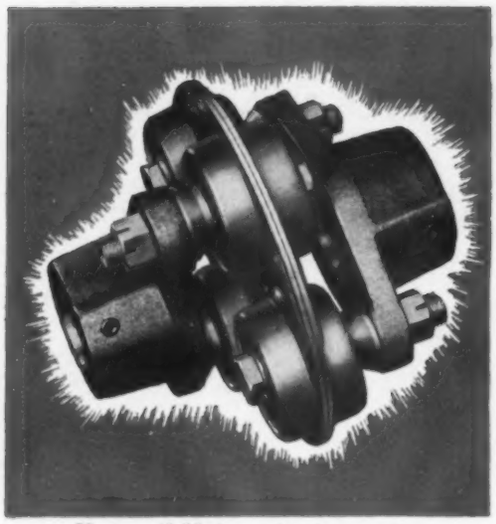
HOW YOU SAVE...

. . . TIME. Instead of buying two devices, you order and install only one. Mounting time is cut as much as 40 per cent.

. . . SPACE. Compact combination starters can be mounted in small unused places near to or remote from the operator.

. . . MONEY. The list price is slightly more than for two separate devices, but the difference is more than made up by savings in wire, conduit, and fittings.

MORE INFORMATION about combination starters is given in our Bulletin GEA-3715A. Ask our local office for your copy.



Now available in 12 sizes in capacities of 8 to 725 foot-pounds torque

IMPROVE PERFORMANCE WITH Morflex Couplings

● An exclusively Morse-designed feature, the Neoprene biscuit assembly *packs the load* in the Morflex Coupling. No metal-to-metal contact; bearing wear reduced. Shock and vibration are absorbed. Positive, direct drive permits no power loss. No maintenance; Morflex is sealed against dirt and weather . . . requires no lubrication! • *Single* Morflex is designed for up to 5° misalignments. *Double* Morflex handles extreme misalignments and universal drive connections. • Address your application problems to Morse Chain Company, Detroit 8, Mich.

Why the Morflex Coupling is Torsionally Resilient (soft)

Fig. 1—Section of trunnion block in free state before insertion into housing. Note that due to the special shape of the block, the internal stress is constant throughout its volume under all conditions.
(A) Compressed on diameter when inserted into housing.

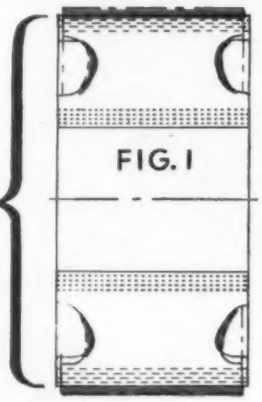
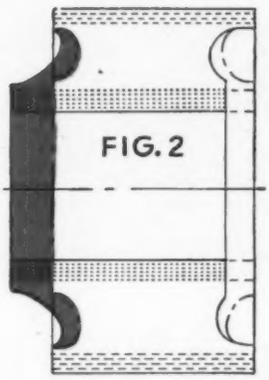


Fig. 2—Axial displacement resulting from thrust loads.



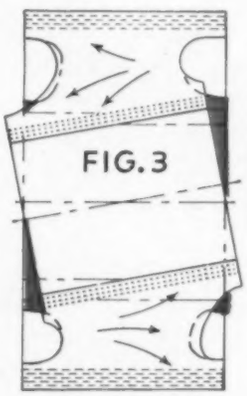


Fig. 3—Angular deflection. Displacement of Neoprene, as indicated by arrows, resulting from angular misalignment of connected shaft.

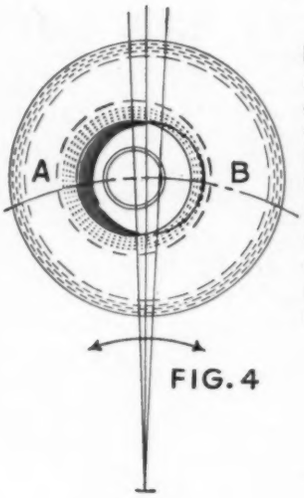


Fig. 4—Torsional deflection resulting from torque loads and torsional vibration. When the block is inserted into housing, the Neoprene is initially loaded. The torque load increases pressure at side A, and reduces pressure at side B, but under the maximum torque, the Neoprene at side B is still loaded.

A PRODUCT OF B-W BORG-WARNER

MORSE ROLLER and SILENT CHAINS
SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES

Surface Broaching of IRREGULAR FORMS•

★ Irregularly shaped parts having curved, slotted, beveled or serrated surfaces may be broached on Footburt machines at high production rates. Surface broaching is now being used in many plants to produce work similar to these illustrations, with higher production per machine and lower maintenance cost than was possible with former machining methods. We will be glad to work with you on the possibility of applying surface broaching to your work. Just send blueprints of your parts with information on number of pieces per hour required.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

UNBRAKO

REG. U. S. PAT OFF

STARS OF THE ASSEMBLY-LINE!

Yes, "Unbrako" Socket Screws are the favorites of shopmen everywhere, because they know that the "Unbrako" Screws can be depended upon for great strength, accurate threads . . . and finest service.

The knurled "Unbrako" Socket Head Cap Screw—(at left)—is a time- and money-saver, because it can be screwed-in faster and farther before using a wrench. How come?—the Knurled Head provides a slip- and fumble-proof grip, even for oily fingers.

The "Unbrako" Socket Set Screw with the Knurled Point—(at right)—is a Self-Locker, because the knurled point digs-in and holds firm—against even the most stubborn vibration! Yet, this screw can easily be backed-out with a wrench and used again and again.

These screws come in sizes from #4 to 1½" in diameter; full range of lengths. Write for the "Unbrako" Catalog, today, for further information. **"Unbrako" and "Hallowell" products are sold entirely through distributors.**

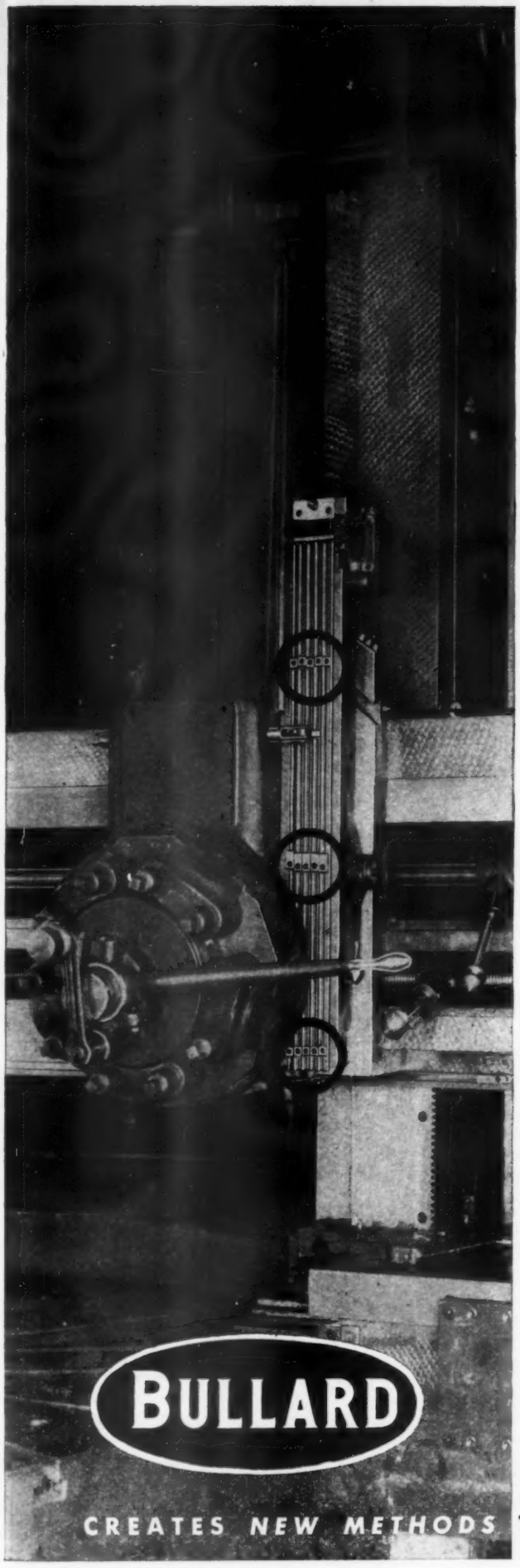
Knurling of Socket Screws originated with "Unbrako" in 1934.

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4

BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

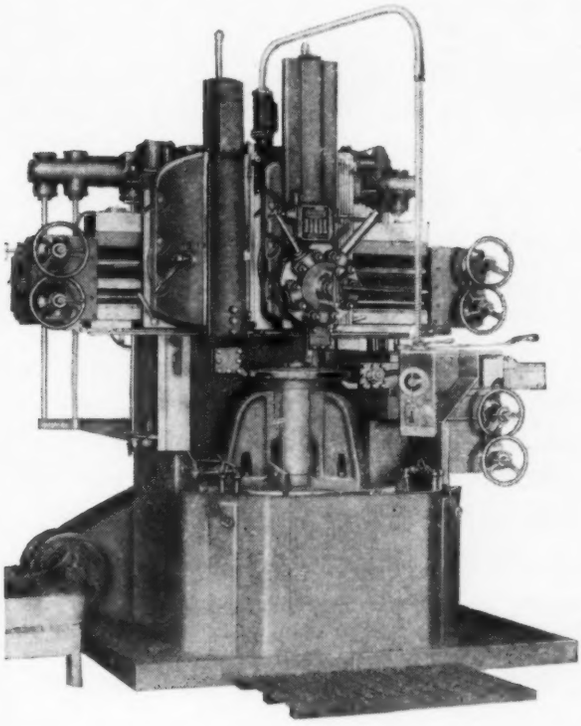


HOW BULLARD CUT MASTERS DUPLICATE DIMENSIONS SAFELY AND CONSISTENTLY

Bullard's skill in applying electrical-hydraulic control systems to machine tools...as exemplified by the Cut Master Vertical Turret Lathe's revolutionary new Pendant Control . . . is further illustrated by Bullard's method of dimension control through electrical and hydraulic feed stops.

On the saddle of each head of the Cut Master V. T. L., Bullard puts accurate adjustable dogs which are set to dimension limits for work size. When contacted by the moving head, they start a train of mechanical, electrical and hydraulic actions that disengage feed... instantly and accurately, thereby providing automatic sizing of work.

Such an automatic control system not only means that dimensions are easily duplicated but also that no head of a Bullard Cut Master Vertical Turret Lathe ever over-runs the cut or bumps any other head. Other reasons why Cut Masters are the surest means of *cutting time* on and between cuts are covered in Bulletin CVTL-4-1-46. Write for it today. The Bullard Co., Bridgeport 2, Connecticut.



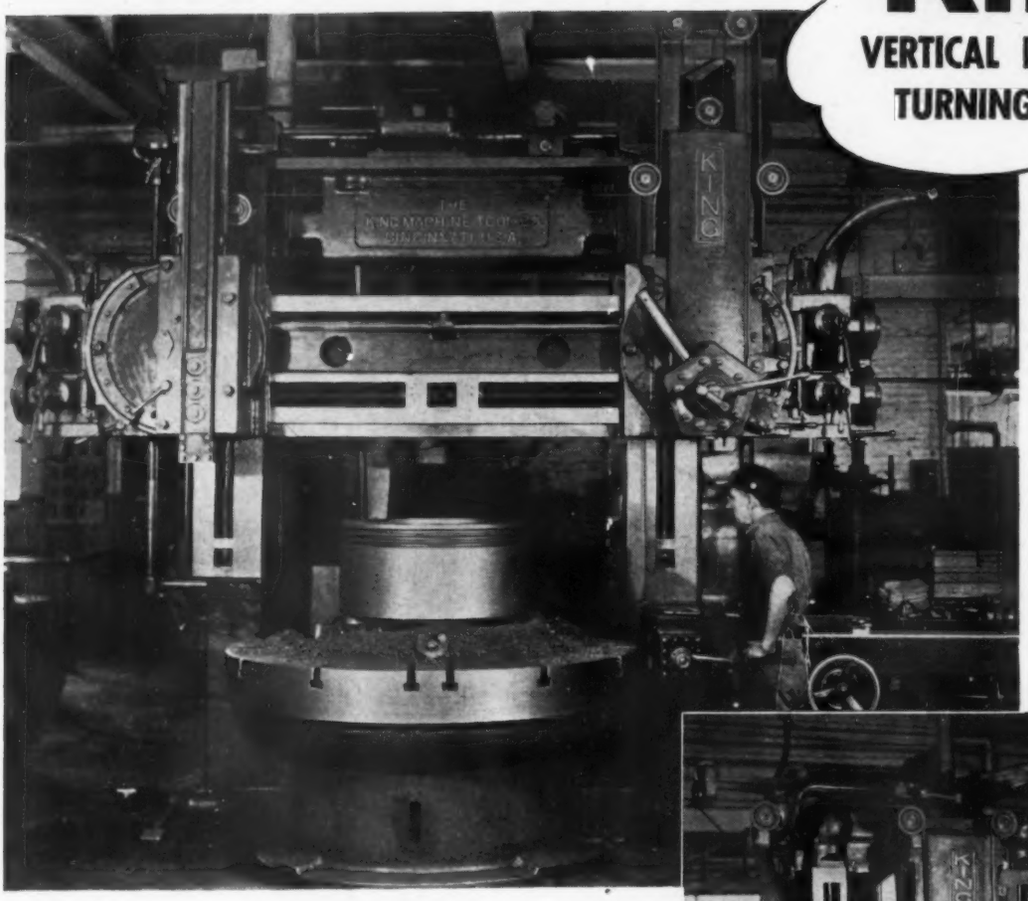
Bullard Cut Master Vertical Turret Lathes are available in 30" and 36" sizes with two heads... in 42", 54", 64" and 74" sizes with two or three heads.

CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

BORING - TURNING - FACING - GROOVING

You can do them all on a **KING**

VERTICAL BORING AND TURNING MACHINE



● Illustrated above, the double column machine has just completed turning and grooving operations on the work shown. At the right the single column machine is boring the center hole in a piece already turned to desired diameter.

These operations are typical of the hundreds of jobs being handled on King Machines in industrial plants—machine tool plants, railroad shops or wherever accurate boring, turning, facing and similar operations are required.

Whether your work requires a double column machine from 52" to 12 feet or a smaller single column from 30" to 42" there's a King Vertical Boring and Turning Machine that will handle it quickly—accurately—economically.

For ultimate economy and continued satisfaction put your next job on a KING Vertical Boring and Turning Machine.

THE KING MACHINE TOOL COMPANY
CINCINNATI 32, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

This Picture was Produced for YOU!

Arrange now for a showing in your own shop—

OF THE

SIMONDS

COLOR-TALKING PICTURE:

"HACKSAWS AND HOW TO USE THEM"

SEE what actually happens in a hacksaw cut! SEE . . . *and show your men* . . . how to choose and use the proper Hand or Power Hacksaw Blade for any type of cutting. This 16 mm Simonds film shows how to get top performance from the top Hacksaw Blades . . . Simonds "Red End" Blades . . . made in 3 types of special steel from Simonds Steel Mills. For a showing of this film, ask your Industrial Supply Distributor or the nearest Simonds office.

SIMONDS SAW AND STEEL CO.

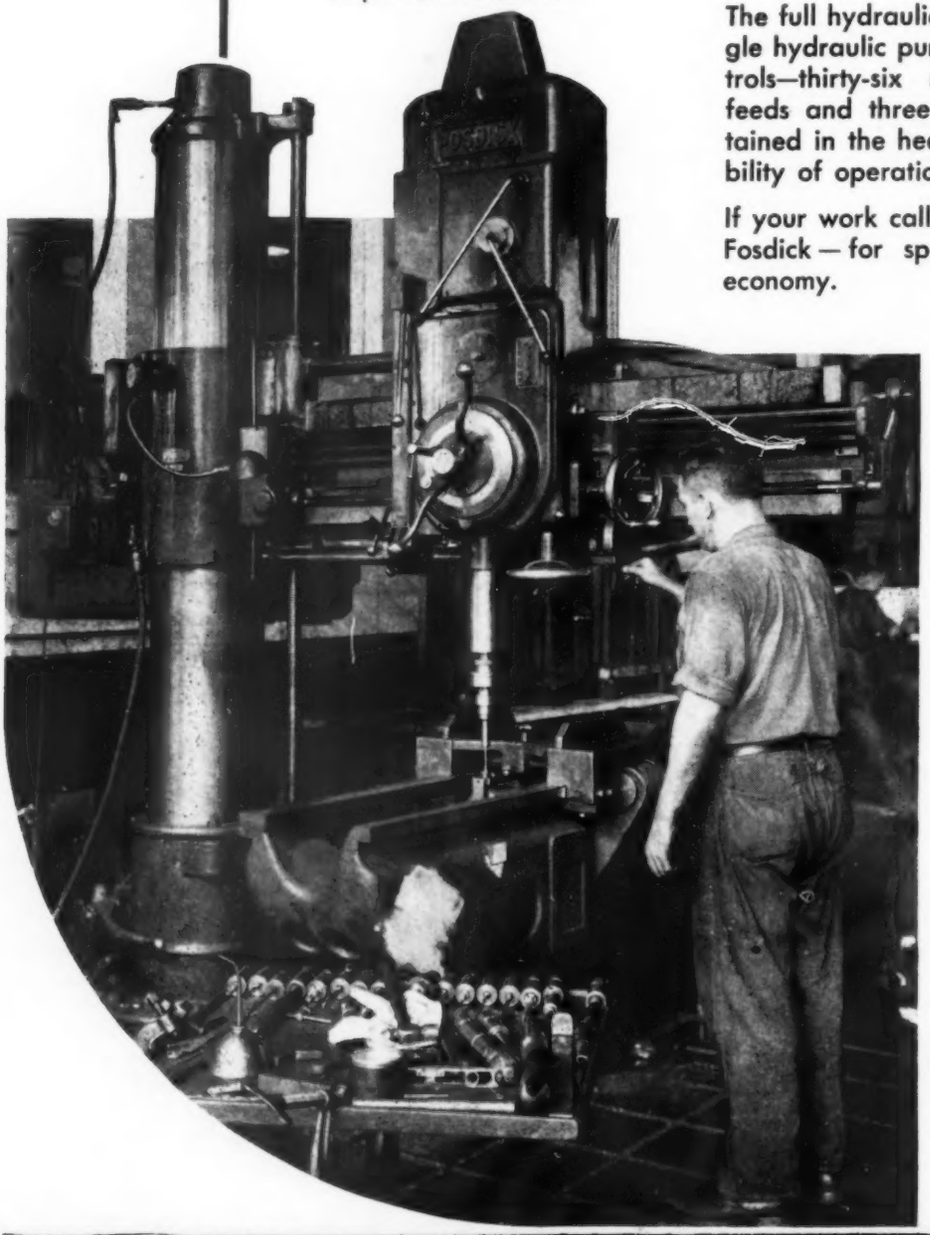
FITCHBURG, MASS.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington. *Canadian Factory:* 595 St. Remi St., Montreal 30.

FOSDICK RADIALS

● Flexibility and accuracy are required in building modern machine tools today. Here a Fosdick Hydraulic Radial is drilling and tapping 1290 pound base castings for the manufacturer of grinding machines.

This is only one of many jobs that find their way to this sturdy, well balanced radial. Not only is it easy to handle but has ample rigidity to maintain required tolerances.



The full hydraulic control by means of single hydraulic pump—centralization of controls—thirty-six spindle speeds—eighteen feeds and three pipe tap leads all contained in the head provide essential flexibility of operation and ease of control.

If your work calls for a radial put it on a Fosdick — for speed — for accuracy — for economy.

●

FOSDICK RADIAL DRILL BULLETIN RA

gives details of construction and operation. *Write for yours today.*

●

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

Higher Wage Costs !

How Staples can help you offset them with properly designed tools

To help offset today's higher wage rates, industry faces the need for higher output per man-hour—a continuous flow of *good* pieces right on down the production line.

Staples Carboloy-tipped Circular Cutting Tools, with their *cemented carbide* cutting edges, are the answer to today's problems of higher speeds, heavier cuts and greater precision. Staples Tools—with the hardest cutting edges known to industrial machining—mean less time out for resharpening, fewer visits to the toolroom, less down time on the line. And they give greater accuracy over longer periods of use.

When you switch to Staples Carboloy-Cemented Carbide Tools, standard or special, you automatically move in the direction of better balance between man-hour costs and man-hour output. Standard tools available from stock; special tools designed to meet your special requirements. Ask your Staples Tools distributor, or write direct. Your inquiry will receive prompt attention.

ASK FOR NEW BOOK
ON BETTER
HOLE FINISH AT
LOWER COST

• New 64-page Staples Catalog-Manual describes the full line of Staples Tools and includes illustrated instructions on how to use circular cutting tools for better results and lower costs.

THE STAPLES TOOL COMPANY
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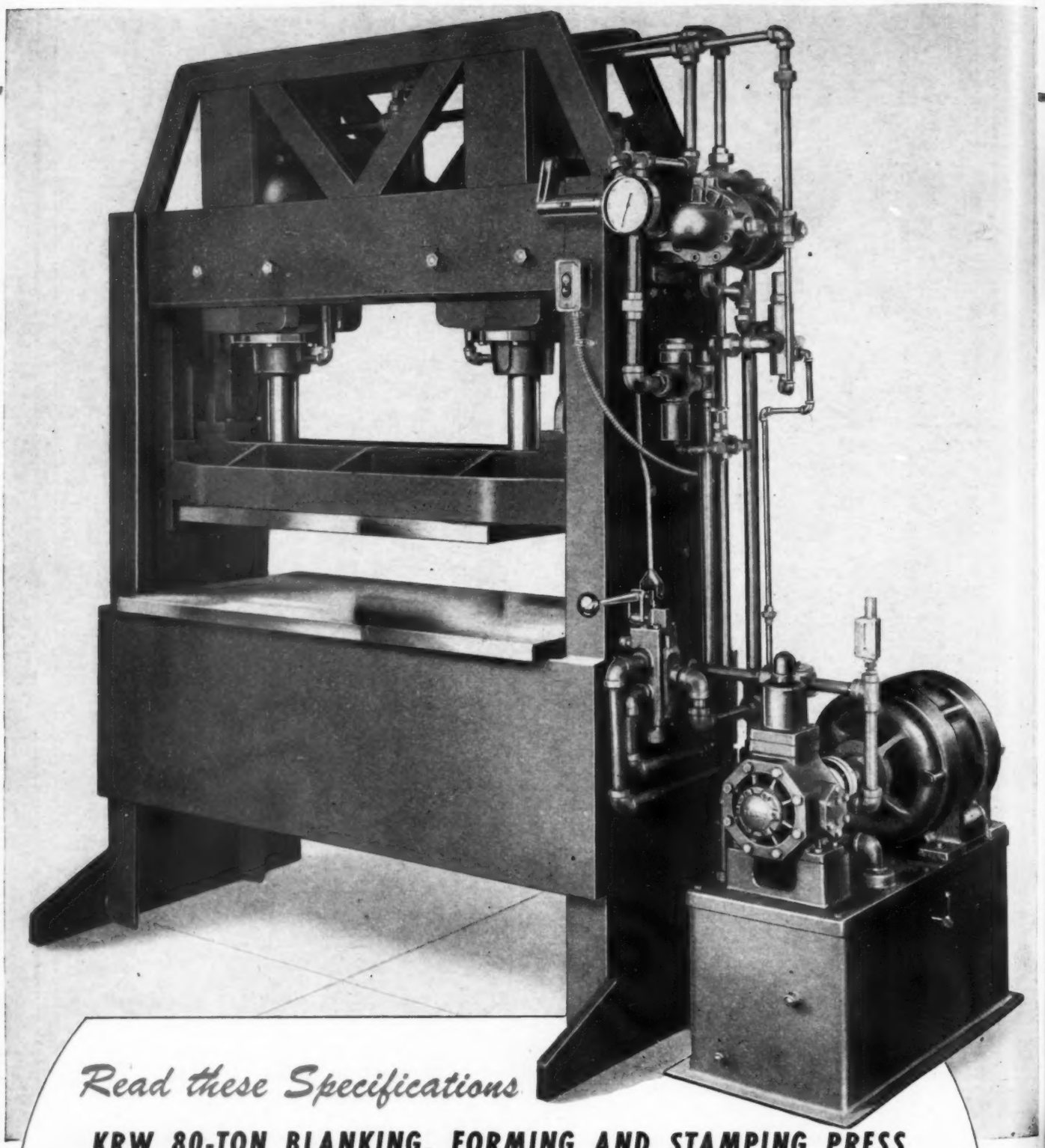

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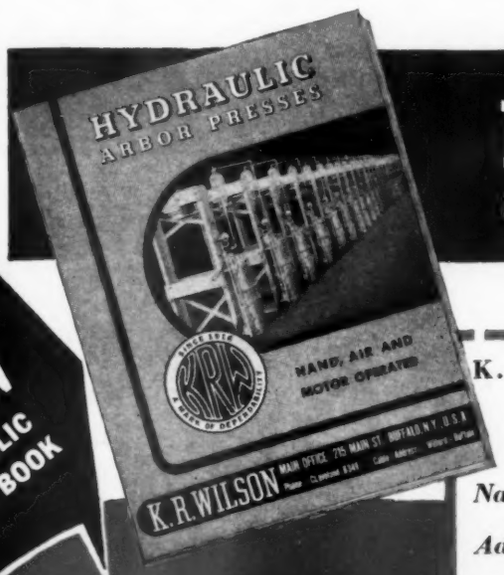

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11

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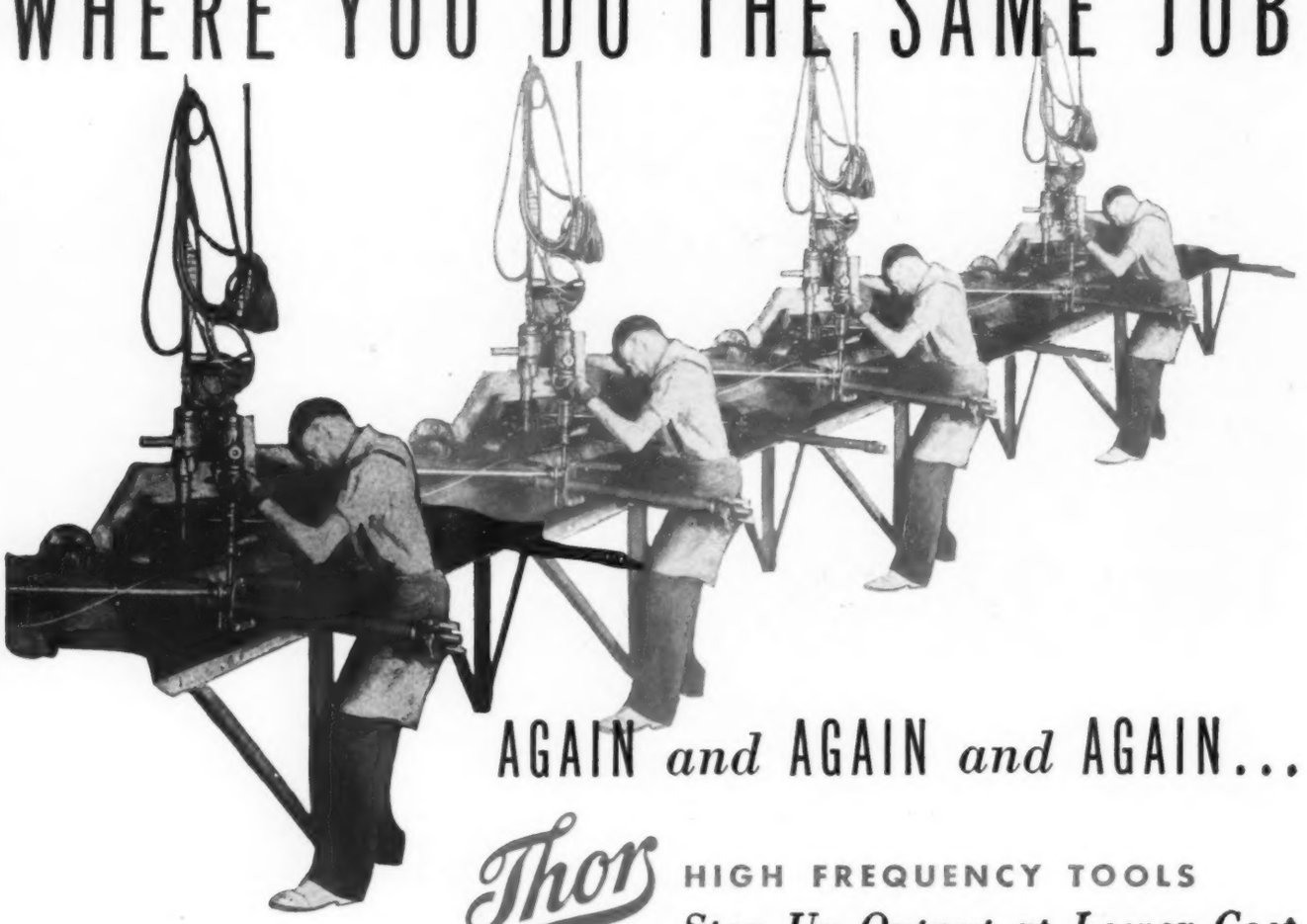

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Operating on 180 cycle current, Thor High-Frequency Electric tools maintain virtually *constant speed* under load; have *more power* per pound; are light, compact and *easier to handle*. These characteristics provide extra efficiency for increased production with less cost. Running at unvarying, full-rated speed, the tools deliver greater work and power output in relation to power input . . . reducing operating cost. Maintenance costs are lower, too, because Thor high-frequency tools are made with fewer motor parts—all extremely simple and subject to little wear.

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NEW PRODUCTION TYPE METAL DRILLING MACHINES
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Direct Drive SUPER SERVICE Upright Drills, designed especially for high production industries, embody flexibility with single purpose simplicity, efficiency and durability. To show how this is accomplished without sacrificing adaptability and convenience, this booklet is presented. These simple, rugged, manufacturing type machines are a prime requisite of the automotive, electrical, home appliance, farm equipment, and other mass production industries. For more holes per dollar—Cincinnati Bickford Drilling Machines.
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See our condensed catalog in Sweet's File.

Equal Efficiency of Every Unit Makes the Balanced Machine

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

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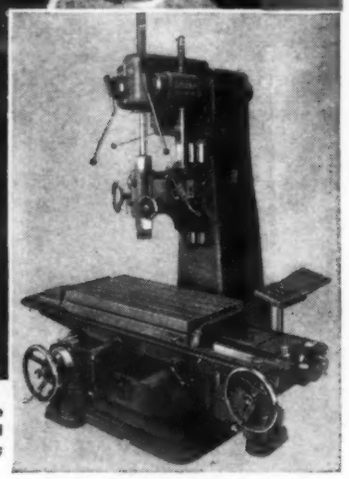

In a matter of seconds the teeth alone are heated to hardening temperature and then quenched. Only the teeth are hardened, and distortion is minimized —speeding production of Cleereman jig borers (inset). G-E heaters are flexible; various jobs can be handled simply by changing the heating fixture.

G-E Electronic Heaters are making it possible for the Cleereman Machine Tool Co. of Green Bay, Wisconsin to heat-treat and finish gear and clutch assemblies at 1/5 the former cost —and get *better* gears in the bargain!

Describing this amazing cost reduction, Cleereman's Chief Engineer states: "To arrive at our savings, we have considered the change in operations which permits us to finish-broach the bore of the gears before cutting and hardening—which *eliminates* the need of *grinding* the bore. In addition, we are getting a *more accurate gear.*"

Heat-treating and finishing costs were reduced from $2.05 to $0.35 per unit, thanks to the elimination of the grinding operation and a material reduction in the cost of heat-treating.

Electronic induction heating has solved many production problems involving the application of heat to sharply defined areas, treatment requiring rapid heating, and the brazing or soldering of small or complex assemblies. General Electric also has a complete line of electric furnaces for all types of heat treating, as well as small unit heating devices. Our heating specialists will gladly submit unbiased recommendations on the type of electric heating equipment best suited to your job. *General Electric Company, Schenectady 5, N. Y.*

ELECTRONIC HEATERS

GENERAL ELECTRIC

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American Machinist's Spot NEWS OF METALWORKING

Automobile industry will be prevented by shortage of materials from producing 6,000,000 units in 1947. Highest production estimate for next year is 4,800,000 units. Steel will be the biggest bottleneck. Automotive executives believe there are at least two 6,000,000-car years ahead, provided retail prices do not go too high.

Private plane with ability to fly non-stop coast to coast will be put on the market shortly by a prominent manufacturer. It will seat three, have two-way radio, will sell for somewhat over $3,000.

Russia is planning to build 800,000 to 1,000,000 cars and trucks a year by 1950. This compares with a pre-war volume of 200,000 units annually. Five new truck models, ranging from 2 1/2 to 7 tons capacity, and three passenger cars, including the four-seater "Moskvich" and seven-passenger Zis-110, already are in production. Largest expansion will be at the Gorky plant, where 1000 units a day, mostly trucks, will come off the assembly lines.

Electroplating of magnesium is now being done successfully. Work is being carried out on a small scale at present, but shortly is expected to be on a production basis.

Impatience at government delay on reconditioning plans for surplus tools has caused several tool builders to proceed on their own, buying up surplus machines, reconditioning them and reselling them. One leading builder bought 60 of his machines from surplus for this purpose.

> Worker efficiency is improving in automotive industry, though irregular production makes it hard to measure. One big company reports efficiency at only 66% of prewar standard, but its manpower output is rising. General Motors is not feeling any resentment by workers as result of the prolonged strike; in fact, GM's efficiency curve has turned upward and the management is much gratified.

Turkish State Railways and Turkish State Seaways will buy $10,000,000 of railway rolling stock, railway maintenance equipment ships and ships accessory equipment in America. Delegation will be headed by Fuat Zencirkiran, with headquarters at Turkish commercial counselor in New York.

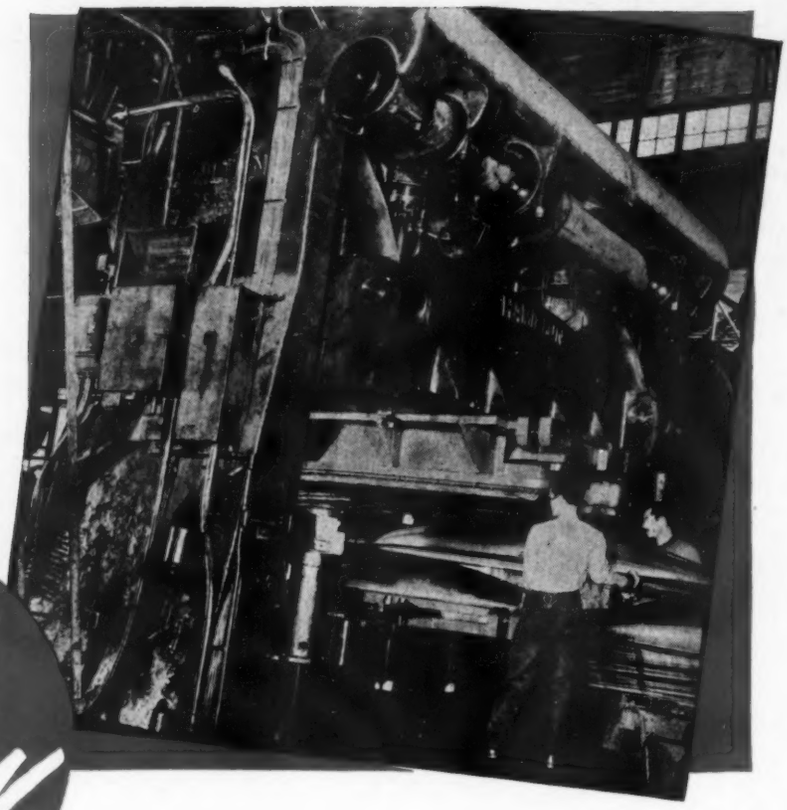
Canada appears heading for a rash of strikes similar to the epidemic in this country. Strike plans call for more than 100,000 workers to be affected in seven industries.

Manhattan District expects by mid-June to announce terms and conditions for releasing radio-active by-products resulting from uranium fission at Hanford and Oak Ridge. Because of the quantities available, releases will be limited to research and developmental projects.

Some of the foremen's disciplinary functions are being transferred to enlarged industrial relations departments in companies in which foremen have been unionized. In one sizable company an industrial relations man parallels each of seven union district stewards.

French automotive industry will not be able to reach its goal of 165,000 vehicles this year because of shortages of machine tools, coal and metals. It plans for 250,000 units in 1947 and 350,000 in 1948, eventually leveling off at 500,000 cars and trucks a year. The total five-year program involves manufacture of 1,000,000 passenger cars, chiefly less than 8-hp. rating; 200,000 light trucks; and 400,000 heavy trucks (more than two-ton capacity).

CIO gained an important point in wage regulations to be issued for new plants. NWBS decided that either area or company rates in other plants should be taken, but if neither could be applied, industry comparisons could be made. CIO wanted industry comparisons as the guide. This may prove a detriment to expansion in the South or in other low-pay areas.



Now . . HYDRAULIC OIL THAT Prevents Sludge and Rust

STOPPAGES of hydraulic mechanisms may occur at any time, and they generally come suddenly, with no apparent warning. Most stoppages are caused by: 1) *sludge,* due to oxidation of the hydraulic oil, and 2) *rust,* due to moisture that gets through ordinary oil film onto the metal parts. Rust is particularly likely to form during periods when the machine is idle.

Texaco Regal Oils (R & O) are strongly inhibited against both rust and oxidation. They stand up under high temperatures and agitation —preventing sludge formation. They "plate" the surfaces of valves, gears and other parts with a rust resisting film so that moisture does not reach metal surfaces. In addition, *Regal Oils (R & O)* will not foam. This means smooth, dependable operation.

Texaco Regal Oils (R & O) have proved themselves in service on all types of hydraulic units, from giant presses to small machine tools. One nationally famous user writes that they *". . . . have eliminated the difficulties formerly experienced with oil varnish in the hydraulic system."* Leading hydraulic equipment manufacturers use and recommend *Texaco Regal Oils (R & O).*

There is a complete line of *Texaco Regal Oils (R & O)* to meet every hydraulic machine requirement. For full information, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT STARRING JAMES MELTON WITH HIS GUEST, ED WYNN — CBS

ESTABLISHED 1877

American Machinist

BURNHAM FINNEY, Editor

Work, and More Work

Production of goods is the nation's paramount economic need. If goods were pouring out of our factories in huge quantities, most of our present economic ills would have vanished.

But what do we find? We look at Detroit, center of the country's mass production, and see the dilemma which American industry faces.

One automobile company, typical of all, is planning its operations only two weeks ahead. Another company has been able to make only one-fourth the cars it had expected to make.

Strikes and shortages have compelled a third company to change its year's quota of production ten times in the last eight weeks.

General Motors divisions report that in the middle of May the plants of 142 parts suppliers were strikebound. Other car makers are no better off.

Two prominent automobile companies are taking in parts and materials in whatever quantities they can be secured, regardless of balance. The result is that inventories are the largest and the most unbalanced on record.

Certain common types of steel products—bolts and nuts, for instance—are scarce. The supply is dwindling daily. OPA restrictions have made it unprofitable for mills to make the kind of steel from which bolts and nuts are fabricated. The same holds for spring wire as well as for other items.

Parts are hard to get, not only because of strikes, but also because old-line parts makers have been forced by OPA price rulings to abandon long-established items and make instead other items on which a profit is possible.

Whereupon new producers come into the market and sell parts at considerably higher prices, with OPA's blessing.

Confusion, bewilderment and uncertainty are the consequences. Manufacturers are forced to go along on a week-to-week basis. They do not know what their costs are or should be, because operations are so irregular.

They are unable to push up production to sufficient volume to get costs down.

Amidst this frustration of economic recovery, shortages of all kinds of consumer goods are rampant. Black markets are flourishing. Prices are soaring. The fear of excessive inflation grows stronger.

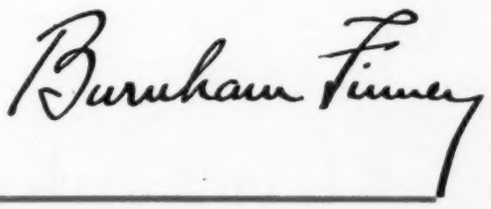
Action which will bring to an end these undesirable practices and their evil consequences lies largely outside industry's hands. Government and labor can do the most to correct the situation.

OPA recently has shown more understanding of industry's plight than in the past. But further relaxation of its restrictive rules is necessary if the former relationship of manufacturer and supplier is to be restored. In fact, the best way to correct matters is to lift ceilings completely on industrial products.

There must be an end to the government's encouragement of workers to strike. Mr. Truman's forthright handling of the railroad strike and the action of the House of Representatives in backing him up give hope of a new attitude by government.

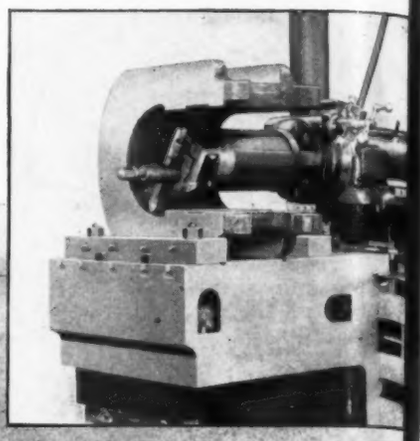
Beyond that, however, and most important of all, there must be in the hearts and minds of American workers the desire "to get out the goods." That spirit has too long been absent.

The sound cure for our economic ills, is, as Mr. Truman suggests, work, work and more work. Idleness inevitably breeds decadence and disaster. Work, on the other hand, leads to production and prosperity.

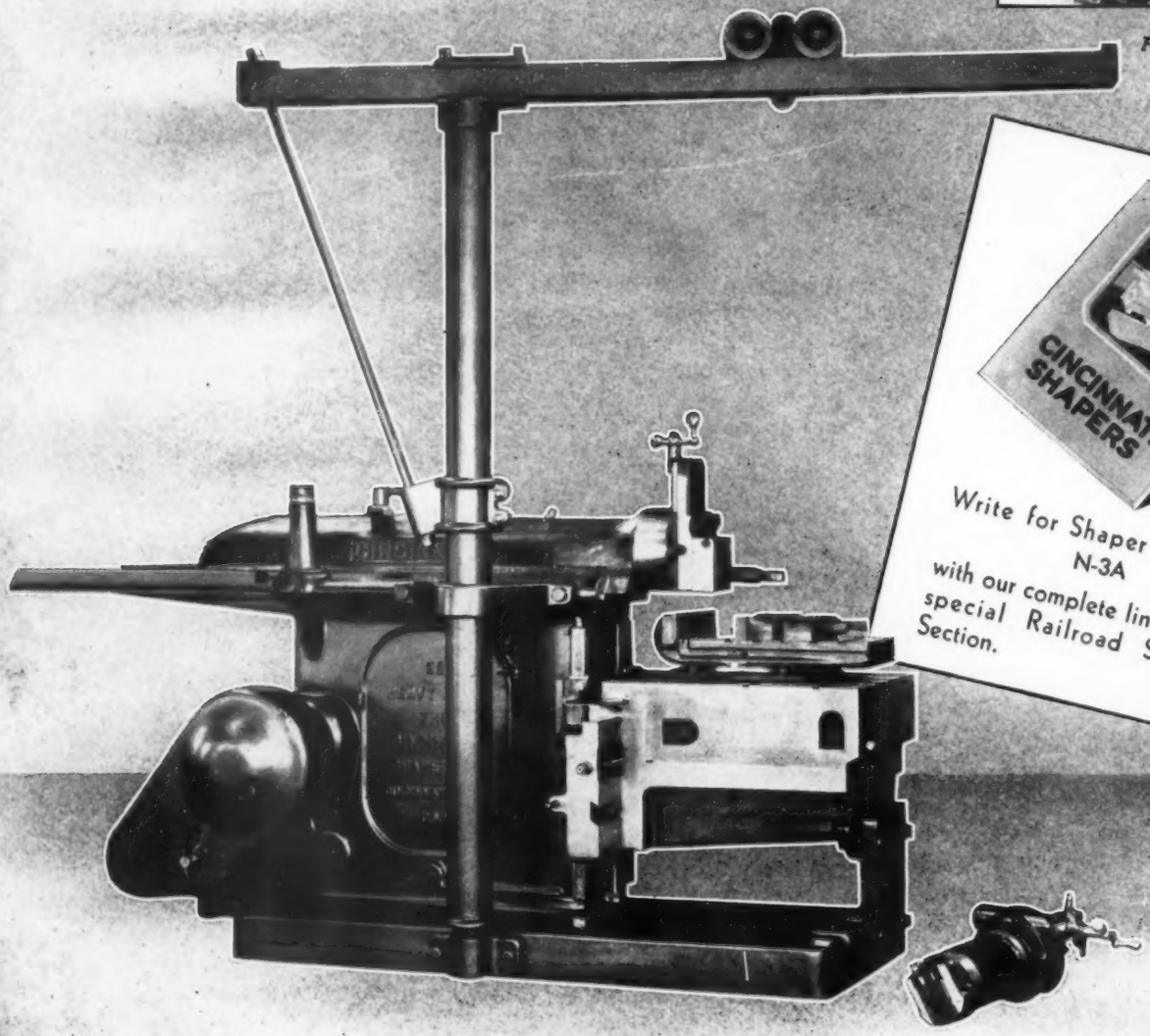


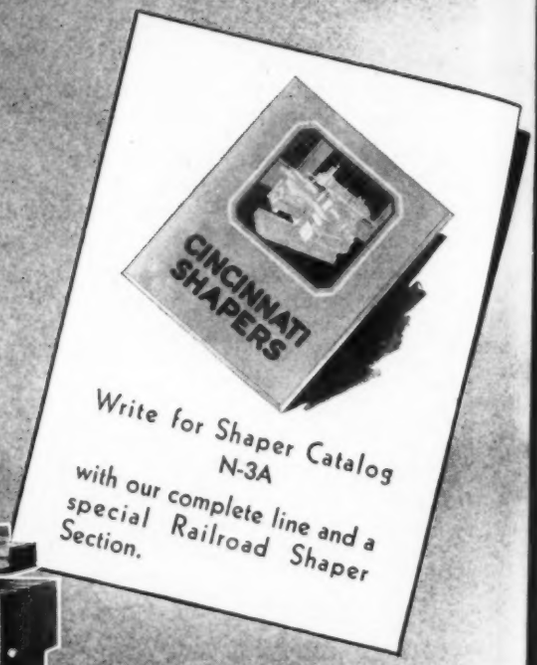
A SPECIAL FOR THE RAILROADS...

A special driving box table—a special circular feeding head—boom crane—shoe and wedge chuck and main rod brass attachment are features that "fit like a glove" in railroad maintenance work. Machining the largest-driving boxes as well as cross heads, shoes, wedges, main rod brasses with speed and accuracy—and with quick set-up on every job—Cincinnati Railroad Shapers bring a new ease and economy to the railroad shop.



Planing Crown Brass Fit





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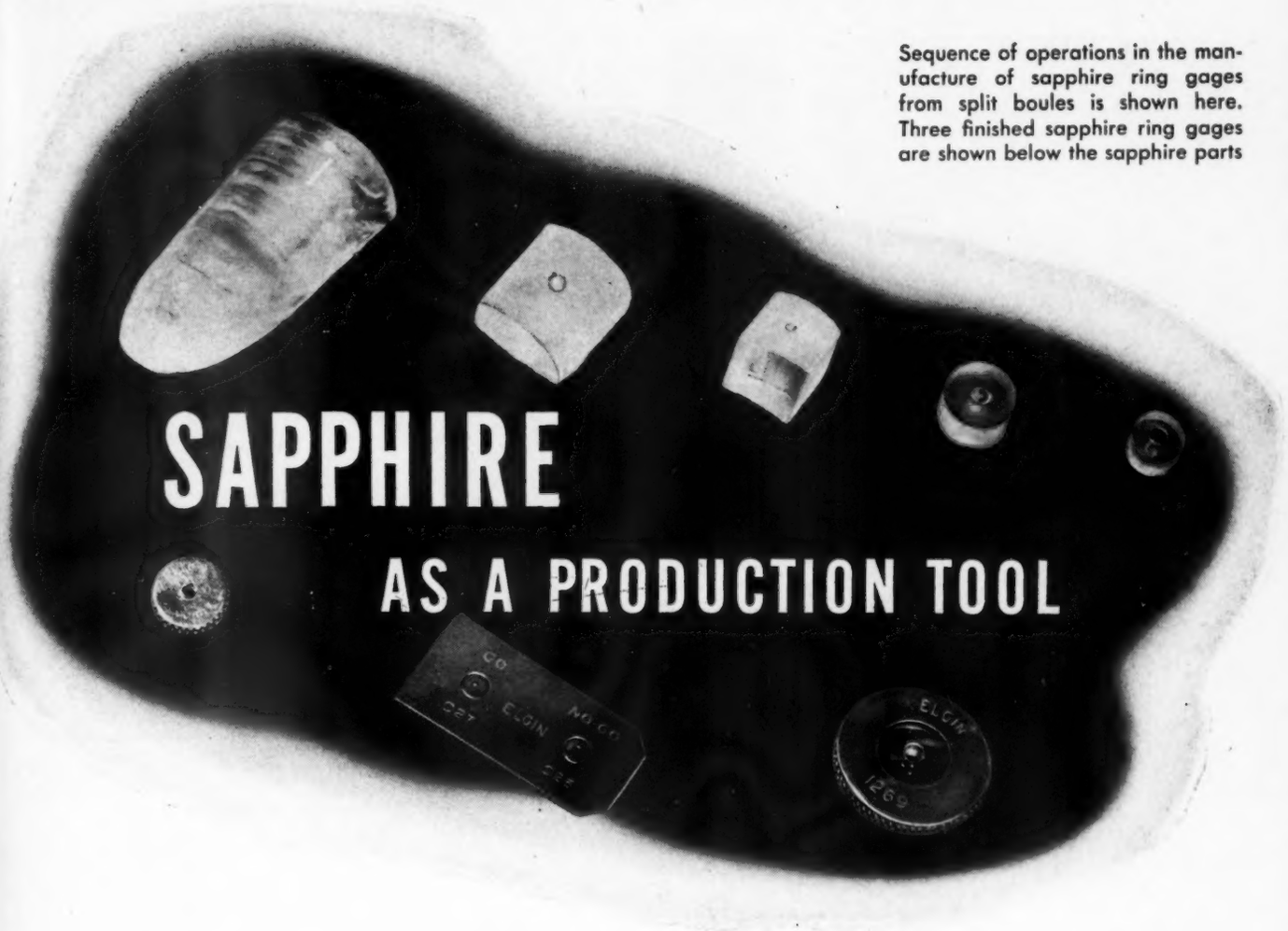


Sequence of operations in the manufacture of sapphire ring gages from split boules is shown here. Three finished sapphire ring gages are shown below the sapphire parts

SAPPHIRE AS A PRODUCTION TOOL

By ROGER F. WAINDLE

GENERAL MANAGER, SAPPHIRE PRODUCTS DIVISION, ELGIN NATIONAL WATCH COMPANY

A war-developed synthetic jewel has a variety of metalworking applications because of its high hardness. Its characteristics and properties are summarized

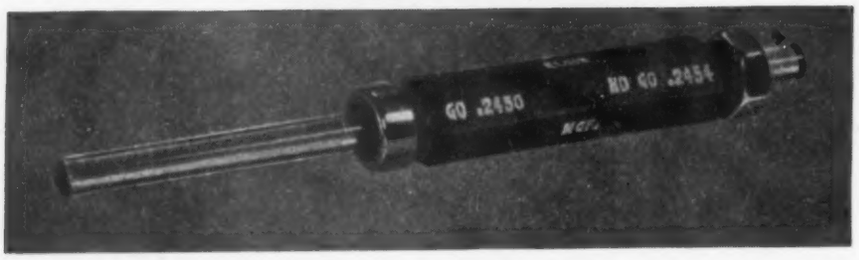
SAPPHIRE is the sesqui-oxide of aluminum, having the chemical formula Al_2O_3. It is of the corundum family, and as used industrially today is the purest of the family of gem stones known as blue sapphire, ruby, etc. More common members of this family are emery and the aluminum oxides known commercially as Aloxite and Alundum. These better-known industrial materials are not as pure nor as hard as either natural or synthetic sapphire, are of different crystalline structure, and find their primary application in grinding and polishing operations.

Sapphire is a natural crystal of the hexagonal type. While the popular conception of its color is blue, it occurs in almost every hue, depending upon the impurities it contains. Pure, monocrystalline Al_2O_3 is transparent and water-white in color. To date, while extensive "alloying" experiments have been conducted in the manufacture of synthetic sapphire, virtually every color of the spectrum has been obtained without improving the physical and mechanical qualities of the pure material.

A distinct improvement over nature is found in the man-made synthetic sapphire, which is produced to a purity and in controlled sizes and shapes impossible to nature. The result is a new engineering material with a combination of hardness and toughness exceeding that of any other man-made material.

Sapphire is harder than any common cemented carbide and in most observed applications has greatly superior wear resistance. On the other hand, in its present stage of development, sapphire is usually (although not always) observed to be less resistant to impact. Compared to some sintered carbides, such as boron carbide, sapphire is not quite as hard, but is much tougher. Comparative wear resistance of sapphire and boron carbide has not yet been completely determined, it being observed that either one or the other of the two is better under circumstances not always comparable. Sapphire, then, must be considered along with other types of hard, wear-resistant materials for industrial applications.

Synthetic or manufactured sapphire is monocrystalline and completely non-porous. It will not burr, corrode nor become distorted with use. Chemically it is practically inert, hence is not affected by any chemical ordinarily encountering in gaging. Industrial and other com-



Finish-ground sapphire rods for plug gages usually are hand lapped with diamond dust (as at top) for precise sizing and high polish. This is one of the two most common industrial uses for synthetic sapphire thus far. (The other is in jewel bearings.) An assembly gage is below

CHARACTERISTICS OF SAPPHIRE

Hardness, Moh scale (Diamond = 10)	9
Knoop scale (Diamond = 6500)	1500-2000
Modulus of rupture, psi	65,000-100,000
Elastic modulus, psi	55×10^{-6}
Compressive strength, psi	300,000
Av. linear thermal expansion coefficient	3.3 x 10-6/0F.
Coefficient of friction, sapphire on steel	0.14
Stability on aging	No change
Melting point	3722° F.
Specific gravity	3.99

Resists all acids and alkalis, does not absorb, or dissolve in, water

mercial possibilities of this material have not been explored fully. To date it has been used with success in the manufacture of jewel bearings for watches and aircraft instruments, for making precision plug and ring gages, cutting tools, spray nozzles, burnishing wheels and insulators, and for phonograph needles. Sapphire gages are very strong and stand up well under the shocks of ordinary handling in use, but like other very hard materials must be protected against hard blows.

Origin

The manufacture of sapphire and its large-scale fabrication in the United States is a war-born development. The process of artificially growing crystals of sapphire has been known since just after the turn of the century and production of sapphire has been carried on in at least three foreign countries for many years. Until the start of World War II, all of the synthetic sapphire and ruby used in the U. S. was imported.

When, in 1940, it became evident that our supply of synthetic sapphire would be cut off, several companies having some acquaintance with the fabrication of refractory materials were asked to equip themselves for large-scale jewel-bearing production. The largest of these fabricating plants was established by the Elgin National Watch Company, which also set up research projects on the manufacture and fabrication of sapphire. These projects included the processing of diamond used throughout the manufacture of sapphire products for all cutting and polishing operations. The Linde Air Products Company with its engineering facilities and possession of sources of large quantities of oxygen and hydrogen, soon became the first commercial producer of sapphire in the United States.

It is interesting to note that within a little more than a year, American ingenuity had already outstripped some 35 years of work in this field in foreign countries. The result is a new integrated industry, independent of foreign sources, which has produced shapes, qualities and "alloys" only dreamed of a few years ago.

Manufactured sapphire is an artificially grown crystal. Finely powdered alumina is fed through an oxygen-hydrogen flame, melting and impinging on a refractory pedestal in a high-temperature furnace chamber. This pedestal is made to withdraw slowly for production of stocky "boule," more rapidly for rod manufacture, and rotation has experimentally produced

tubing, disks and many other shapes.

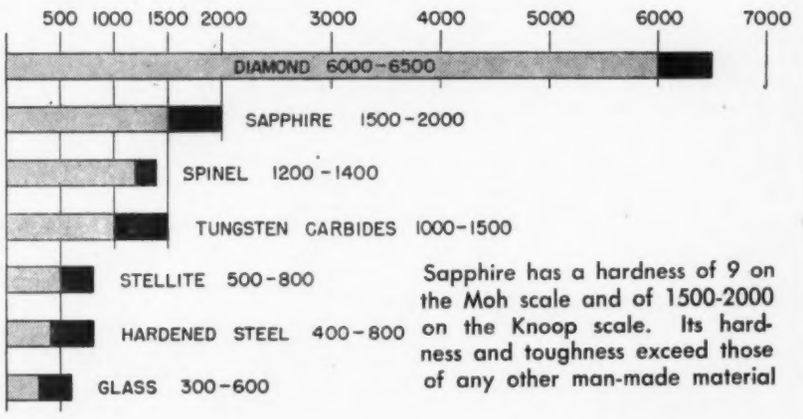
Fabrication is accomplished entirely with diamond; the material is sawed, ground, lapped and polished with charged, bonded and loose diamond tools. Most of the machines have heretofore been specially designed, but experience demonstrates that more and more operations can be adapted to modified standard machine tools. One of the interesting phases of this work has been the improvement of manufacturing operations, with resulting reductions in production costs. For many years, loose diamond has been mixed with high-purity olive oil for the lapping operations. Recent developments in synthesized vehicles have led to a saving of up to 75% in diamond consumption, with equivalent improvement in cutting results. Developments to date indicate that as more and more applications are found for synthetic sapphire, and more fabricating problems are solved, the cost of production can be reduced to broaden the horizon of useful applications.

Until recently, with the exception of a few isolated cases, almost the only industrial application of synthetic sapphire was in "jewel bearings"—a necessary item for most precision instruments. The largest consumption of such bearings has always been in fine watches. Here finishes in the order of fractional microinches have been common for many years in both journal and bearing. The high compressive strength (300,000 psi.) and the extraordinarily low coefficient of friction between metals and polished sapphire puts this material in a class by itself in precision-instrument bearings.

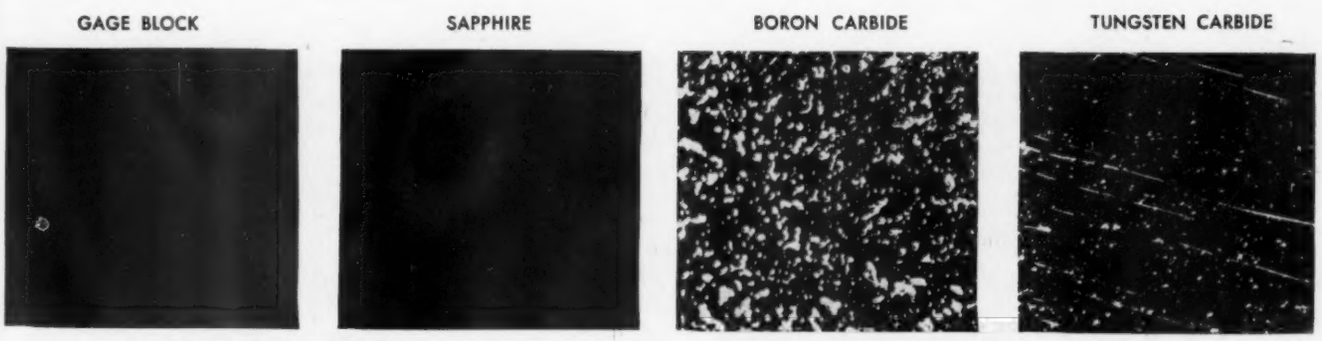
Outside this field, most industrial applications of man-made sapphire have been in burnish-cutting soft metals and dimensional-control gages.

Elgin has been using sapphire tools for many years in both hand and machine operations on fine watch

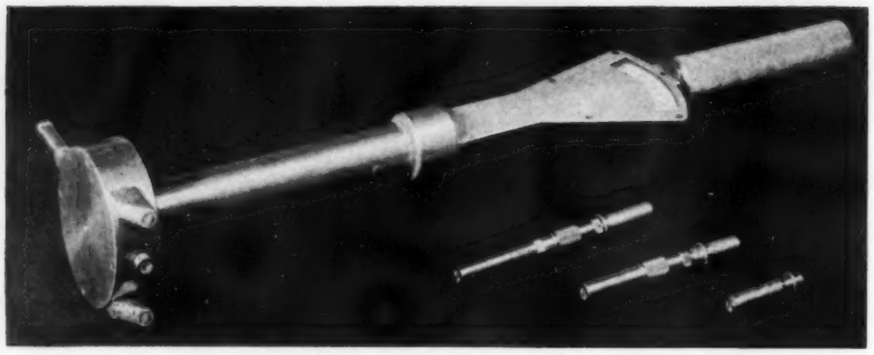
Sapphire rods are cylindrically ground with a copper drum having diamond dust impregnated in its periphery. A small roll supports the rod against the revolving drum in this centerless-grinding operation



Sapphire has a hardness of 9 on the Moh scale and of 1500-2000 on the Knoop scale. Its hardness and toughness exceed those of any other man-made material



50X PHOTOMICROGRAPHS prepared by Armour Research Foundation under dark-field illumination compare the surface porosity of polished sapphire with the polished surface on a Johannsen gage block, and on polished boron carbide and polished tungsten-carbide surfaces



SAPPHIRE wear strips or plates can be inset in steel blocks with special cement, as indicated in the V-block assembly at left. This material also has been used to make dial-indicator points, comparator and micrometer anvils, gage backstops and gage points, as on the bore gage at right

parts. Some of the machine setups have been multiple-tooled. Characteristics of sapphire that recommend it for cutting and burnishing tools are hardness, non-porosity and ability to maintain a very high finish. The only limitation found to date in applying sapphire cutting tools to the harder metals has been their fragility, which currently is being reduced by developments in methods of processing. Properly designed tools have a long life, work rapidly and impart a mirror finish to the work. Their usual application is to fine, precision boring and turning operations on relatively small parts.

Gage applications have been pursued on a larger scale. When the war ended, some 250 producers of war goods had installed sapphire plug or ring gages, dial indicator points, comparator-gage anvils and backstops, V-blocks, or wear strips on special gages. The first sapphire gage made by Elgin in March, 1943, still is in use.

Market prices for sapphire gage parts now average 1.0 to 2.5 times that of comparable tungsten carbide gages, and 1.0 to 1.5 times that of boron carbide gages. On the other hand, average market prices at present for wear-resistant dial indicator and comparator points are about as follows: sapphire—$3.50, tungsten carbide—$4.50, boron carbide—$7.50, and diamond—$10.00 to $15.00. Experience gained during the war with the manufacture of sapphire products is resulting in the development of better, more efficient methods which are making it possible to make many sapphire parts, such as wear strips, machine parts, etc., at a cost comparable with or less than tungsten carbide and chrome-plated high-speed steel parts, where quantities justify production tooling.

Sapphire as an engineering material is in its infancy, but a review of its properties will show that it has many application possibilities. Already it is being used to make thread guides for the rayon industry, and in the ultra-violet treatment of blood plasma and serums because it transmits the rays more efficiently than any other known material. Its high-temperature strength and chemical stability recommend it for pressure-vessel and compression-chamber windows, while its hardness and wear-resistance suggest such applications as wear strips and way-facings, or as tips on precision-grinding centers.

TIPS for Top Shop Men

77 If you have supervisors, group leaders or other assistants, pass some responsibility on to them. Make them responsible for getting the doorknob polished, if you can't find something better, but give each a job, then let him get it done his way. Otherwise, assistants become errand boys and you a mere dispatcher.

78 Contrary to the common opinion, slow is *not* sure. A fast worker is not always an inaccurate one. As a matter of fact, a number of studies indicate that the slowpoke is usually also the source of most mistakes. So be very sure of your ground before you tell somebody to "take it slower, and get it right."

79 Quitting time and pay day are of more natural interest to every worker than anything else. If you can indicate what company production objectives or service requirements are, or relate improved daily work to bigger pay checks and faster arrival of quitting time, production will go up. Pride of accomplishment can even be built into a garbage collector, if you study him—and treat him—as an individual worthy of real consideration.

80 Answer the question, "Why?" whenever you can. Early in World War II, morale slumped in one plane plant because workers put on guns, soon took them off again, then put 'em back on. All it took to clear the air was an explanation of changing battle conditions and their direct relationship to company products. Nobody likes to do a job he figures he'll just have to do over.

81 Hunt around for pictures, charts and stores that show how your product is doing the job outstandingly well. Give workers copies to take home so they can show their families what they're doing. Give them a chance to brag a little; it's the quickest antidote for blues.

82 Take a little free time now and then to find out interesting things about your product—and pass 'em on. Where do materials come from and how much do they cost? Are any strategic? Do any come from ancestral countries of workers? These facts always stir interest and discussion that builds morale.

Shaving Costs by the Mill...

BY CHESTER S. RICKER
DETROIT EDITOR

Fractions of a cent in cost per part, multiplied by dozens or hundreds of parts in a product, can spell profit or loss

When the automobile industry is in full production, output is three to six million vehicles per year. Multiply these by 25, 50 or 100 duplicate pieces per vehicle and it runs into billions. That is why automobile production costs for material and labor must be scanned to the tenth of a cent. With the new labor rates, time of operations will be scrutinized even more closely. *Automobile Facts* tells of one company that is studying how much can be saved by eliminating the etching "Safety Glass" on each car window.

Cost engineers now divide a car into each component and tell the purchasing and departmental production chiefs how much of the total cost is allotted to each department. Studies are made of shop layouts, operational methods, power required, direct labor, material and salvage to cut the dollars down to cents and cents to mills.

Nesting Parts

During the war, many airplane builders of the old school squared their material before it went to the forming department. Early in 1942, scrap was running as high as 75% in some plants. Output, not cost, was paramount. Automotive production men soon nested the punchings and took them from a strip instead of from a unit rectangle.

Naturally this required changes in the type of dies so the strip could be fed through the die and press, but reduction in scrap was more than 50%. In the automobile business, 40% scrap is high. One engineer, by combining more than one piece in a blanking die, has increased the average percentage of strip steel utilized from 60 to 83%.

By substituting a self-locking nut for a castellated nut and cotter pin in one car, more than $1,500,000 per year was saved in direct labor, thus offsetting the higher cost of the nuts.

Another automobile company carefully studied the bill of material on bolts, nuts and screws. It was found that many special lengths could be eliminated by using a standard length perhaps 1/15 or 1/32 in. longer or shorter. It is said that this standardization increased the production runs on certain sizes or allowed commercial lengths to be used and effected a saving of over $2,000,000 per year. This is also an important way to prevent shortages at critical times.

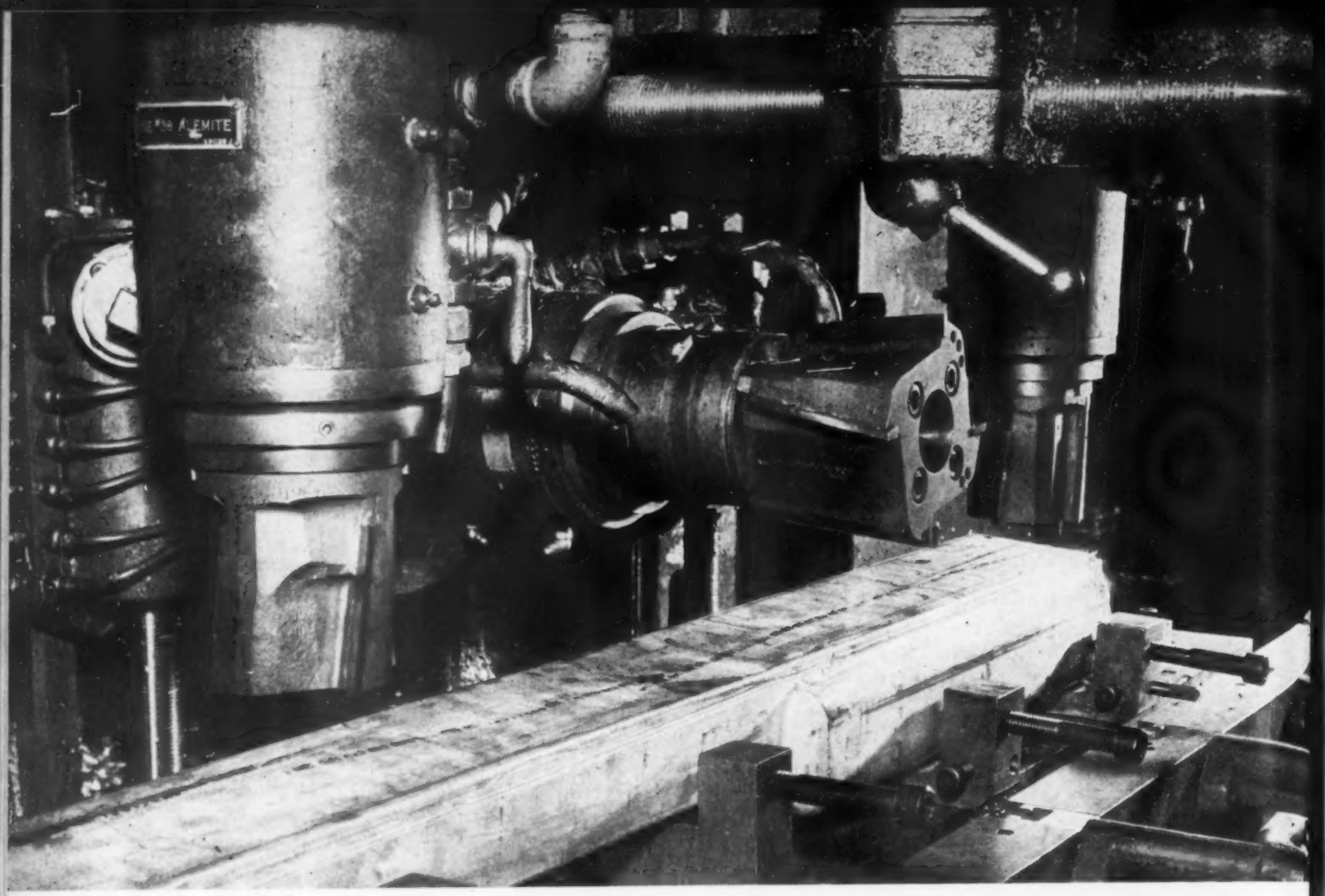
One company buying huge quantities of small screws of several different lengths, but of one diameter and thread, uses them with and without lock washers. They put on the lock washers, where required, at assembly. This cuts in half the varieties of screws required, or doubles the number produced. The savings made in the higher-quantity runs more than offsets the loss of labor time in putting screw and lock washer together.

Cheaper to Buy

TVA's LILIENTHAL, with a workman, was walking through the Oak Ridge, Tenn., plutonium plant during the very busy days while Hiroshima was still a target. Said the workman: "Whatever it is the Government is making in this plant, it would be cheaper to go out and buy it!"

OUR SHOP...3 — *Rate Setting Department*

"WHAT'S HE WORKIN' THRU NOON HOUR FOR, AFRAID OF HIS JOB OR IS HE OUTA TOWN?
PAYMASTER TOOLS
NAW, HE'S TH' NEW PRICE SETTER ON PIECE WORK, AN' TH' BOSS IS HAVIN' HIM TRY AN' MAKE TH' RATE HE SET-ON HIS OWN TIME!!
HELPERS GUIDE
DON'T ARGUE!
1- HAND ME!
2- FETCH ME!!
3- BRING ME!!!
4- GIVE ME!
RESPOND QUICKLY! BE A TOOLMAKER YOURSELF SOMEDAY
BLACKSMITH'N'
OPR 2 REMOVE BURRS
SPAT!!
O. LUHARTY '46



Spar caps produced from 14ST hot-rolled billets required development of a milling technique involving solid-body, carbide-tipped cutters, which are driven by spindles of at least 40 hp.

CARBIDE MILLS ALUMINUM ALLOYS

BY G. R. GWYNNE, PROJECT COORDINATOR
SANTA MONICA PLANT, DOUGLAS AIRCRAFT COMPANY

Certain conclusions regarding the high-speed milling of aluminum alloys are derived from wartime experience in machining wing and empennage spar caps. In this work, it was essential to remove metal as rapidly as possible. Hence, two basic requirements were laid down: (1) spindles of spar cap mills should have at least 40 hp. for roughing and 20 hp. for finishing and would be overloaded 100% while making the pass, and (2) cutter design and materials should be evaluated with respect to finish, rate of production and life between grinds. With these requirements satisfied, seven general recommendations made themselves evident:

(a) Only cemented-carbide milling cutters can be used for milling 14ST and 75ST alloys at high speed.

(b) Solid-body cast cutters with cemented-carbide tips are practical and have the lowest initial cost.

(c) It is desirable to keep above 6,000 sfpm. by using carbide-tipped cutters of 8-, 9- or 10-in. diameter. The higher the speed, the better the finish. Speeds up to 12,000 sfpm. are practical.

(d) Copious quantities of coolant (1:20) are desirable on cutter and work to lengthen time between grinds.

(e) No basic weakness of the standardized cutters was discovered by tests with 20-, 40- and 75-hp. spindles.

(f) Cutter angles should be: helix, 10°; front rake, 5°; primary clearance, 7°; land, 1/64 in. and secondary rake, 15°.

(g) Carbides suitable for this type of work are similar to: Carboloy No. 883; Firthite HA, Kennametal K4H and Vascoloy No. 245.

The above conclusions were reached by means of tests carried out during the early part of the war. Three 6-in. two-bladed cutters, alike except for helix angles of 5°, 10° and 15° were tipped with high-carbon steel, welded hard metal and carbide, and run at 4700 and 5650 sfpm. The cemented-carbide cutters were the only ones that

would make the pass at 60 in. per min., and give a fair surface finish. In a second series of tests, 8-in. four-bladed cutters were used at spindle speeds giving 6280 and 7550 sfpm. Again all tool materials, except cemented carbide, broke down rapidly at the cutting edges and failed to produce a satisfactory finish. Cutters with cemented-carbide tips were the only ones that stood up when used on 40-hp. spindles. No difference in power consumption was noticed for helices of 5°, 10° and 15°, and hence 10° helix was adopted as standard to simplify grinding. Eight-bladed, 8-in. cutters with cemented-carbide tips 1½ in. wide exploded after the second pass.

No advantage was discovered in the use of serrated jack blocks as compared with solid-body cutters. Also, the solid-body cutters were found to cost about half as much. So, in the majority of cases, cutter bodies were made of cast Meehanite. Here is the machining involved: face the hub, ream the arbor hole, drill and counterbore bolt holes, mill drive slots and recesses for the teeth.

A further comparison can be made of the results obtained with cemented-carbide and high-carbon steel cutters. The latter were used at feeds up to 40 in. per min. and speeds up to 6,500 sfpm. to remove a small amount of metal from 24ST spar cap extrusions. They failed on 14ST and 75ST alloys. The finish was inferior and required considerable polishing on burr benches. Both types of cutters cost about the same in small "standard catalog" sizes, but the cost of the high-carbon steel cutter increases faster with size and complexity or contour than the cemented-carbide tipped cutter, because of heat-treating and machining problems. Carbide cutters can be repaired by inserting new tips but they take more time to sharpen than high-carbon steel cutters.

Cutter Loss Reduced to 3%

Careless handling of carbide cutters is a hazard that can be overcome by proper measures. Methods devised to protect the cutting edges and place responsibility on the operator for such mishaps were:

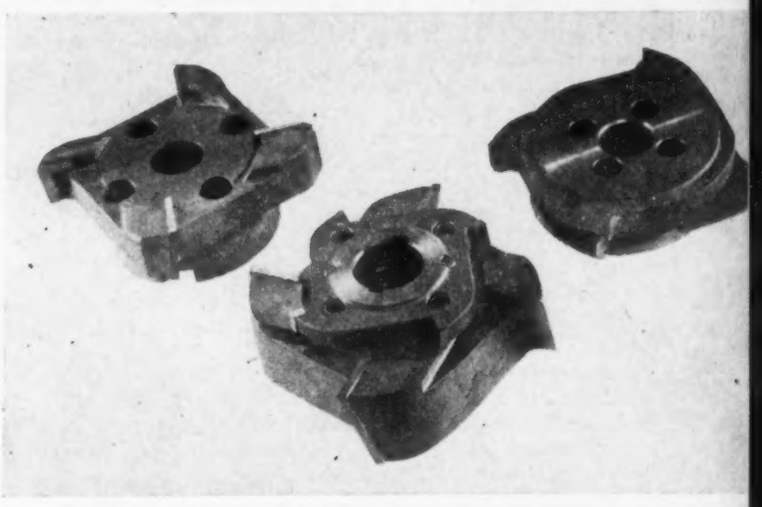
(a) Special wood boxes were developed for all cutters. These boxes prevented injury while in storage or transit.

(b) All cutters were inspected at the grinding crib, again when received at tool storage, also by setup men when drawn from the crib.

(c) White-pine strips are provided at the machine to protect the cutter during setup.

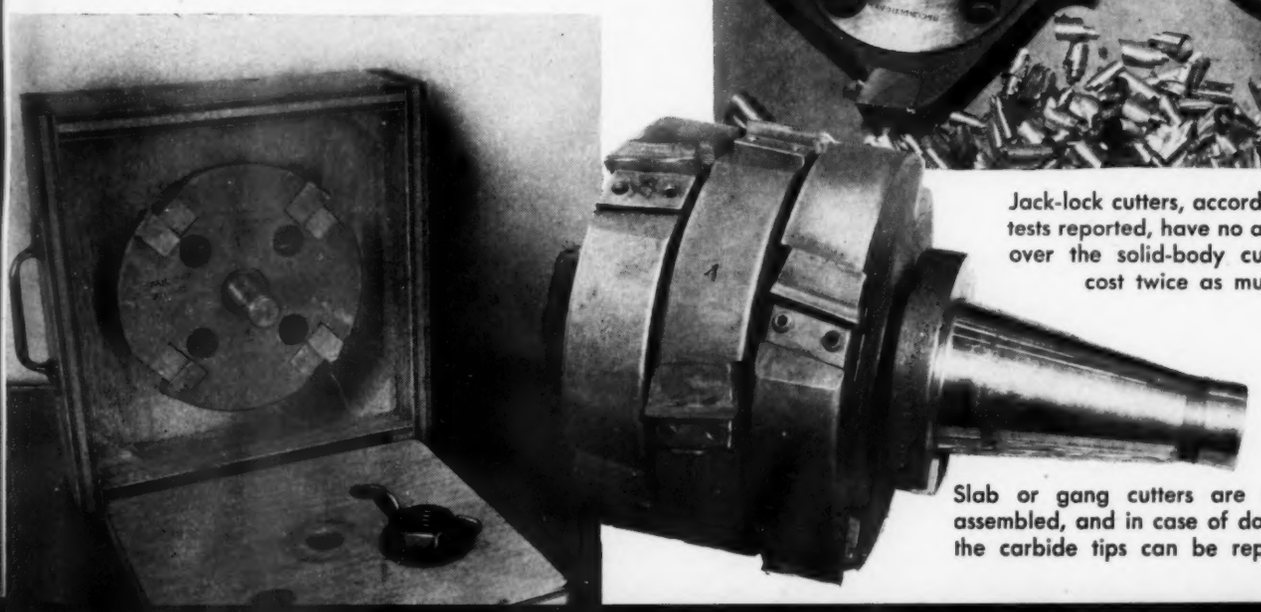
(d) Aluminum S.O. feeler gages were used to determine cutter settings.

Many different styles of cutters are required to handle jobs involving the strong aluminum alloys—14ST, 75ST and, to some extent, 24ST. All styles are easily repaired



Four-bladed cutters 8 in. in diameter will stand up under cutting speeds of 7550 sfpm. and feeds of 60 in. per min. A high-quality finish is secured on 14ST aluminum alloy

Jack-lock cutters, according to the tests reported, have no advantage over the solid-body cutters and cost twice as much



Three cutters are provided for any part number, and each is suitably boxed to prevent injury

Slab or gang cutters are easily assembled, and in case of damage the carbide tips can be replaced

The Understanding Foreman

There are many tough situations involving human nature that a foreman can straighten out by being tactful and considerate

By David T. Armstrong

WHEN A FOREMAN knows his men so well that he will not ask them to do anything unreasonable or beyond their abilities he is by way of becoming a pretty good personnel man. The foreman who masters this intuitive understanding of human beings will be a friendly fellow. He will know his men so well that he will know which to use thick-skinned tactics on and which to deal with gently and tenderly. He knows that when a piece of work is spoiled the man who feels "bad inside" does not require the same type of treatment as the fellow who belches forth the attitude, "Well, whaddya expect, perfection?" Because generally speaking the foreman has worked with the men himself, has been one of them, he knows their capacities, limitations, potentialities. And he guides his conduct toward them on a common-sense application of that knowledge.

Bender Left Bent

William S. Knudsen tells a story about an old chap who used to work for him. This fellow, a fine workman, had the unfortunate habit of going on a "bender" once a month and then not showing up for a day. When that happened once too often, Knudsen told him that because of the bad example he set for the other workers in the shop, he was going to be laid off. That struck the man pretty hard. "Is there anything I can do to keep my job?" he inquired. He really wanted to work and that job was all he had left in life. His wife was dead and his children had married and moved to other sections of the country.

Knudsen didn't feel too good about the matter, but he had committed himself and he had to make a case of it. So he told the fellow to go down to talk it over with the parish priest and take the pledge for a year.

The next morning a venerable gray-haired cleric called and said to Knudsen, "I am Father Joseph and I have come to see you about Paul and his pledge." You can imagine how Knudsen began to glow inwardly in anticipation of praise for his work as a social reformer. "You know, Mr. Knudsen, priests learn a little something about human nature. To the best of my knowledge, Paul has had a drink every day for the past 35 years. If I ask him to sign the pledge, do you think for a moment he is going to be able to keep it?"

After a moment or two of serious thinking, Knudsen surrendered, "All right, send the old sinner back in the morning."

He had learned the principle that it is right and proper to ask men for the best they are capable of and that it is useless to ask for more. The foreman who understands this fundamental personnel policy saves himself a lot of fretting. Furthermore he will have little difficulty explaining to the men why Paul was not laid off or fired for his monthly aberration.

He explains simply and honestly to each inquirer or precedent seeker what he said to Paul and what the priest taught him about industrial relations. He will tell them firmly that he does not approve of the type of conduct that affects production or morale adversely. This does not mean that he will support or endorse every whim or peculiarity evinced by his men. But there is a difference between an occasional aberration and a general inability to conform to what is required of all workers. There isn't a foreman in the business who has found out how to make men work for him and with him, without giving them some margin of freedom for their peculiarities of conduct.

Except Steinmetz

Sometimes management has to learn this fundamental lesson. It is reported that Charles Steinmetz, the electrical wizard, who was an inveterate smoker, taught this to those in authority at General Electric. When a notice forbidding smoking was posted on the bulletin board in the shop where he worked, Steinmetz ignored it until one of the executives asked if he was not aware of the rule and that it applied to every employee. The answer was a cold, indifferent stare. The next day Steinmetz didn't show up, and for two days no one heard from him while important work remained untouched. Then began a search which ended in the lobby of a hotel where he was found taking his ease in a huge leather chair, puffing on a black cigar. Told that the whole company was looking for him and asked why he had left so unceremoniously, he calmly replied, "I came up here to have a smoke!" After that the rule was never applied to him.

Now the average worker is not a Steinmetz nor can the average foreman be a Knudsen. The average worker cannot be as independent as could Steinmetz, but his problem is just as important to him as the matter of a smoke was to Steinmetz. Forty dollars to pay the rent on the first of the month is just as important an economic problem for the average worker as $100,000 for a new plant is to management. Sometimes the foremen, supervisors, and management get the mistaken idea that the problems and difficulties of the men are small compared to the magnitude of the problems faced by management. Such an attitude seems quite unfair. True, the problems are different in their magnitude but they can be equally crushing in their negative effect. Inability to pay the rent means disruption of family life even as failure to build a new plant disrupts a firm's economic life.

A Morning Off

The possible applications of the know-your-men principle being advocated here are quite numerous. Take a case in point. In a shop which does a small amount of welding to very exacting tolerances, a new job came in involving butt welding 1/32-in. aluminum, without buckling or warping the piece. The welder couldn't do the job and reported this fact to his foreman who was smart enough to recognize a tough one when he saw it. He tried to weld the piece himself, unsuccessfully. He arranged for his welder to take the problem up with a welding supply company that believed the job could be done. The man was given the morning off, which he used to good advantage in learning how to weld the piece satisfactorily. Everyone was happy.

But imagine what would have happened if the foreman had said to the man, "Well, you're supposed to be a welder; you ought to know how to weld anything that can be welded."

TALKING SHOP

Unsealed Ceiling

ONE Detroit company reports a typical price-ceiling experience. The foundry that made a clutch pressure-plate casting refused to go on losing money under ceilings. Now the company is trying to educate another foundry—and paying 25% more. OPA refused price relief to the old supplier but permits it for the new. Meantime, materials and manpower are wasted.

Carbiding Officer

C. V. BRINER, retiring ASTE president, handed over to A. M. Sargent a cemented-carbide gavel with plastic handle, and a hardened-steel striking plate, the gift of Carboloy. The gavel head is far smaller than usual—carbide is heavier than lead, so a tough session would, otherwise, give the president an old-fashioned charley horse or tennis wrist.

Everybody's Business

METALWORKING executives are learning, the hard way, that the big post-war problem is not technical advance but developing a winning personality. In early plants, the owner knew every employee. Now plants have grown so large management is insulated from labor by layers of supervision. Under such conditions, misunderstanding and suspicion thrive. Like it or not, management must come back to the point of telling its troubles to labor and enlisting cooperation. Your problems may be nobody's business but yours, but keep 'em to yourself and your business will be nobody's.

Miniature Plant

TIMKEN ROLLER BEARING has established a miniature pilot plant—complete except for steel mill and heat-treat—at Zoarsville, Ohio, where new methods are tested before being applied on a factory-wide basis. Present staff is 8 women and 10 men; eventual staff is 150. They handle a half-million dollars worth of facilities, test everything from idea to practice—even sending out instructors when the method is approved. The electronic inspection equipment for use by blind operators, described in *American Machinist* several months ago, was developed there. Admission is with letter from the 4-man control committee only.

Comic—For You

"FLU" FLUHARTY, who draws "Our Shop," comes forth with an idea. He suggests you send your pet ideas, wise or otherwise, and your picture, with permission to caricature, to E. J. Tangerman, managing editor. Then says "Flu": "Tangerman, being a shop man, will follow usual shop practice and pass the buck to me—and I will fix you up—so help me!"

Unblind Venetians

VENETIANS, with their canalized traffic, had several good ideas. Kids grew up near water, so made good mariners for the fancy sail-and-oar-powered merchant ships. But more than that, wear and friction were cut to a minimum in their transportation equipment. Our reason for mentioning it is the fact that only in one case we know of has our civilization taken added advantage of water as a means of reducing friction. That was in the tremendous circular display that Ford had at the N. Y. World's Fair. On terraced shelves, parts were displayed, topped by a complete car. To support and rotate it would have taken heavy bearings and a big motor and gear. Instead the engineers floated the whole business in a sunken tank of water and turned it with a motor a fraction as large.

Pezzame

ITALIAN pumice is here again—the first shipload having just been reported by James H. Rhodes & Co., Long Island City, N. Y. Of volcanic origin, pumice is the most-used natural abrasive. It breaks down rapidly and contains no obsidian (hard, scratchy particles). Here's where our hand soaps, tooth powders, and general polishing go back to the prewar basis.

Bride and Broom

ONE of Britain's top scientists defines a biologist by telling this story: A very ladylike broom leaned over toward her companion in the closet and said, "I've been meaning to tell you—very soon now I'll be presenting you with a little bristle." Her companion drew himself up and insisted, "I don't know how that can be. We haven't swept together for over two years!"

Horse Doctor

THE PERSONNEL MANAGER at Aeroproducts, Dayton, has been accused of using horse-doctor technique in picking men, but it works. If the interview shows the man has the basic qualifications, the P.M. closed the interview with a story that should elicit a belly laugh. If it does despite the tenseness that an interviewee always feels, the P.M. knows the prospect's sense of humor is good enough to carry him through the tough situations that crop up in a big shop. What's more, the P.M. gets a good look at the prospect's teeth (the horse portion of the analysis). If the teeth are good, regular and clean, the man's health is good and his work habits are clean too. Teeth, says the P.M., are a lot safer to judge by than are clothes—which someone else may have chosen (or lent) for the occasion.

Tooth Contact

BY ERNEST WILDHABER, GLEASON WORKS

Resuming his series on hypoids, the author now discusses the question of tooth contact and develops the method for finding the required tooth profile curvature

IN PREVIOUS ARTICLES, the concept of a limit pressure angle was introduced, which in theory would result in a surface of action tangent to the pitch cones, and which corresponds to a zero pressure angle in bevel gears. Actual pressure angles should be different from the limit pressure angle by a safe margin; as in involute teeth, zero pressure angle should always be avoided. The merit of this concept of limit pressure angle will now be brought into full view, and further interesting aspects of it will be revealed.

It was also shown how the pitch surfaces and the pitch lines thereon are related to one another on hypoid gears, and how the lengthwise tooth curvature and the pitch angles are interdependent.

The teeth of hypoid gears contact much in the manner of bevel gears. Spiral teeth contact at any instant along lines inclined to the pitch lines, that is inclined to the lengthwise direction of the teeth. At any small portion of the line of instantaneous contact, mating teeth contact like two cylindrical surfaces, whose relative curvature is a measure of the tooth surface strength.

The Instantaneous Contact

The inclination of the instantaneous line of contact to the pitch tangent at a mean pitch point P will first be determined.

Fig. 26 is a view of the pitch plane of a pair of hypoid gears, whose axes intersect the plane at O', O''. The axes are inclined to the pitch plane at pitch angles γ, Γ and are projected as lines $O'P$, $O''P$. The pitch tangent t is contained in the pitch plane. The normal plane PC_c is perpendicular to tangent t.

Fig. 27 is a view of the plane tangent to contacting tooth surfaces at mean point P. It contains the tangent to the line of instantaneous contact I and the pitch tangent t, to which it is inclined at an angle w.

The normal plane through P, Fig. 28, contains the limit normal and the limit center of curvature C_c thereon. The limit-normal plane contains limit normal PC_c and pitch tangent t.

It has been shown in an earlier issue, that any straight line, which passes through C_c and is contained in the limit-normal plane, qualifies as a possible contact normal of the hypoid gear pair, that is as a normal at a point of contact between the gears. Some of the pitch-plane normals also qualify as contact normals. It will be shown here that these pitch-plane normals all lie in a vertical plane PU, Fig. 26, which is parallel to the instantaneous axis of the gear pair, and is inclined at an angle λ to the projected pinion axis $O'P$, and at an angle $(\psi_p - \lambda)$ to the pitch tangent t. $(\psi_p - \lambda)$ is defined in formula (22) hereafter. This vertical plane intersects the limit-normal plane in a straight line, which passes through P, and is inclined to the pitch plane.

At any point S of this intersection line, both the pitch-plane normal SS' and the line C_cS of the limit-normal plane shown in projection in Fig. 28, are possible contact normals. Any straight line passing through S and contained in the vertical plane of the two possible contact normals is, therefore, also a possible contact normal.

In proof thereof a force extending along said line is resolved into components in the direction of the two established possible contact normals. The resultant force exerts turning moments on the pinion and the gear in the ratio of their numbers of teeth, if, as assumed, each component force also exerts turning moments at that ratio. A line extending along the resultant force, therefore, qualifies as a contact normal.

The vertical plane C_cS, Fig. 26, intersects the normal plane PC_c in a straight line C_cC_n perpendicular to the pitch plane, as shown in Fig. 28.

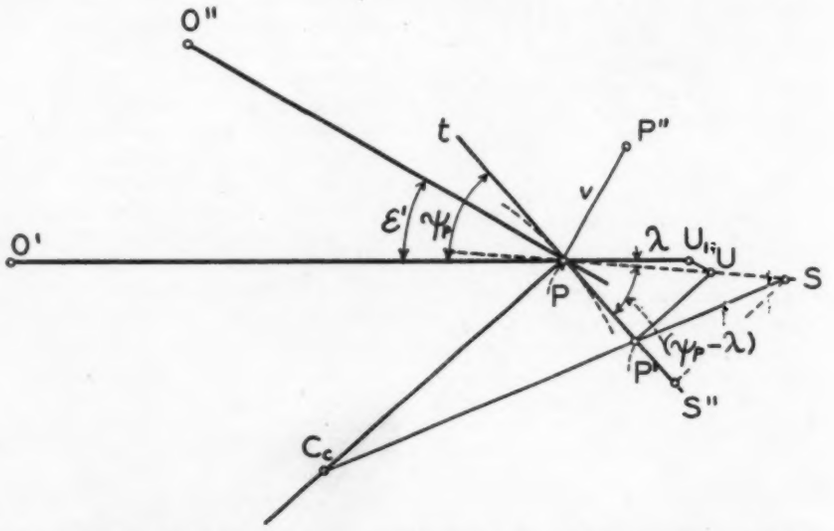


Fig. 26—A view of the pitch plane. Analysis made in the close vicinity of point P. Simple relationships obtained by considering infinitesimal tooth portions

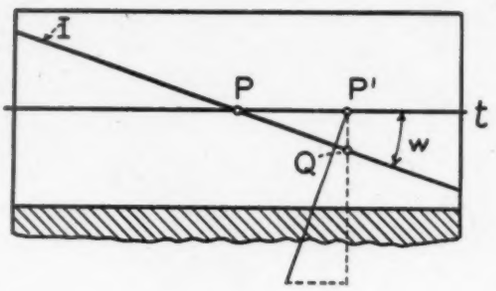


Fig. 27 — The tangent plane of contacting tooth surfaces with inclination w of the line of contact to the pitch tangent

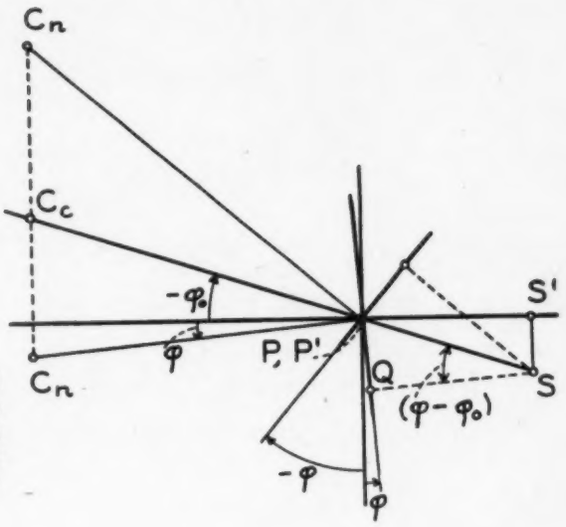


Fig. 28—The normal plane through P contains the limit normal and the limit center of curvature C_c. Tooth surfaces of the gear or of a basic member are considered which are surfaces of revolution with axes contained in the normal plane and passing through a curvature center C_n vertically below or above C_c

This line C_oC_n is independent of the particular position of point S on line PS.

A tooth surface of the gear, or of one of the basic helical members of the hypoid pair described in an earlier issue, will now be considered. This is a surface of revolution whose axis coincides with line C_oC_n. The tooth surface may be a conical surface or a surface of curved outline.

The normal drawn from any point S of line PS to this surface qualifies as a contact normal, for it is contained in the vertical plane C_oS, Fig. 26. This contact normal intersects the tooth surface in a point of contact Q, Fig. 28. The whole line of instantaneous contact is therefore simply the normal projection of intersection line PS to the tooth surface.

The considered surface of revolution passes through point P, and its radius C_oP, Fig. 26, is equal to r'' defined in formula (16) of an earlier issue. Its normal at P is inclined at the pressure angle ϕ to the pitch plane, and intersects the axis of the surface at a point C_n below the pitch plane.

Inclination angle w of the instantaneous line of contact to the pitch tangent is obtained by projecting line PS to the plane tangent to the tooth surface at P. Formula (23) which appears later is based on this relationship. The formula is not confined to a surface whose axis is perpendicular to the pitch plane, provided that the axis passes through C_n and is contained in the normal plane. Surfaces of a common outline, passing through P, are equivalent for curvature when their normal radius PC_n is the same.

Moreover, when the tooth surface considered is a spherical surface whose sphere center is at C_n, no restriction is imposed on the direction of its axis, as the formula for tan w will always apply.

The formula (23) also applies to the opposite side of the teeth, when its pressure angle ϕ is there introduced as a negative quantity. C_n is then above the pitch plane, see Fig. 28.

On gears with intersecting or with parallel axes, $\phi_o = 0$, $\lambda = 0$, $\psi_p = \psi$, the formula assumes the shape

$$\tan w = \tan \psi \sin \phi$$

which appears as formula (5) in the articles on bevel gears.

In the hypoid formula (23) a spiral angle $(\psi_p - \lambda)$ intermediate the pinion and gear spiral angles appears in place of the common spiral angle ψ of bevel gears. And, most important, the difference $(\phi - \phi_o)$ of the pressure angle ϕ minus the limit pressure angle ϕ_o appears instead of the pressure angle ϕ alone.

Use of Limit Pressure Angle

Equal inclinations of the line of contact to the pitch tangent are obtained on both sides of the teeth by keeping the pressure angles equally different from the limit pressure angle, so that $(\phi - \phi_o)$ is numerically the same on both sides. Thus when $\phi_o = -10°$, the inclinations w are balanced for instance with pressure angles of 10° and — 30° on the two sides. $(\phi - \phi_o)$ is then 20° and —20° on the two sides. The formula owes its simplicity to the introduction of the limit pressure angle.

The proof will now be given that all pitch-plane normals contained in vertical plane PU are possible contact normals, and formulas (22) and (23) will be derived.

The pitch-plane normal at P intersects both axes, and any line intersecting both axes can always be a contact normal. In general a normal, which belongs to one member of a hypoid gear pair or to one of the basic members described in an earlier issue, is in a position of contact when its relative motion with respect to any one of said members contains no component lengthwise of the normal, so that all points of the normal move instantaneously at right angles to it. This condition is fulfilled for the pitch-plane normal at P. It is equally fulfilled for all normals parallel thereto which lie in a plane parallel to the instantaneous axis, because these pitch plane normals all have the same distance from the instantaneous axis and are equally inclined to it. They all have the same instantaneous relative motion, which is a helical motion about and along the instantaneous axis. This proves that all pitch plane normals in vertical plane PU are possible contact normals.

Vertical plane PU contains a line drawn through P parallel to the instantaneous axis. The direction of this line can be obtained by geometrical addition of angular velocities. Angular velocity ω' of the pinion is plotted as a distance PU_1 on a line drawn parallel to the pinion axis; angular velocity ω'' of the gear is plotted at the same scale as a distance U_1U on a line drawn through U_1 parallel to the gear axis, to obtain a line PU parallel to the in-

stantaneous axis. Length PU in space moreover measures the angular velocity ω_i about the instantaneous axis.

In the view of Fig. 26, ω', plotted parallel to the pinion axis, appears reduced to $\omega' \cos \gamma$; and ω'' appears as $\omega'' \cos \Gamma$. Point U_1 is located a distance $\omega' \sin \gamma$ above the pitch plane. Point U is located $\omega'' \sin \Gamma$ below point U_1, and a distance $(\omega' \sin \gamma - \omega'' \sin \Gamma)$ above the pitch plane.

The inclination angle i_k of line PU and of the instantaneous axis to the pitch plane can now be readily determined. $\sin i_k$ is the proportion of $(\omega' \sin \gamma - \omega'' \sin \Gamma)$ to the actual length PU, which is ω_i. Accordingly

$$\sin i_k = \frac{\omega' \sin \gamma - \omega'' \sin \Gamma}{\omega_i}.$$ Also

$$\frac{\omega'}{\omega_i} = \frac{\sin \Gamma_k}{\sin \Sigma}\ ;\ \frac{\omega''}{\omega_i} = \frac{\sin \gamma_k}{\sin \Sigma},$$ for

which see (5). Hence

$$(21)\ \sin i_k = \frac{\sin \gamma \sin \Gamma_k - \sin \Gamma \sin \gamma_k}{\sin \Sigma}$$

Angle $(\psi_p - \lambda)$ is obtained from triangle PUP', Fig. 26, wherein P' is the intersection point of pitch tangent t with a plane perpendicular to it and passing through point U.

$$\tan (\psi_p - \lambda) = \frac{P'U}{PP'}$$

$$= \frac{\omega' \cos \gamma \sin \psi_p + \omega'' \cos \Gamma \sin \psi}{\omega' \cos \gamma \cos \psi_p + \omega'' \cos \Gamma \cos \psi}$$

A_p and A denote the cone distances PO' and PO''. $A_p \sin \gamma$ and $A \sin \Gamma$ are the pinion and gear radii to point P. The peripheral velocity of the pinion is $\omega' A_p \sin \gamma$ at point P; and the gear velocity is $\omega'' A \sin \Gamma$. The components of these velocities in the direction normal to pitch tangent t amount to $\omega' A_p \sin \gamma \cos \psi_p$ and $\omega'' A \sin \Gamma \cos \psi$. They are of necessity equal. With this relationship the above formula can be transformed into

$$(22)\ \tan (\psi_p - \lambda) = \frac{\tan \psi_p A \tan \Gamma + \tan \psi A_p \tan \gamma}{A \tan \Gamma + A_p \tan \gamma}$$

Angle w is determined by projecting point S to the tangent plane of the tooth surface.

In Fig. 26 S'' is the projection of point S to the pitch tangent. SS'' appears here in projection as $PS'' \cdot \tan (\psi_p - \lambda)$. The actual distance of point S from the pitch tangent, as seen in Fig. 28, amounts to $\frac{PS'' \tan (\psi_p - \lambda)}{\cos \phi_o}$. The projection Q of point S has a distance $\frac{PS'' \tan (\psi_p - \lambda)}{\cos \phi_o} \cdot \sin (\phi - \phi_o)$ from the pitch tangent. $\tan w$ is obtained by dividing this quantity by PS''.

$$(23)\ \tan w = \frac{\sin (\phi - \phi_o)}{\cos \phi_o} \tan (\psi_p - \lambda)$$

The Mesh in the Pitch Plane

The problem is to determine the line in the pitch plane, where successive tooth contact takes place, that is the line of intersection of a surface of action with the pitch plane. Specifically the direction of this line is to be determined, or its tangent at point P. This purpose can be accomplished by considering a point P' located at the intersection of the gear tooth surface with the pitch plane at an infinitesimal distance from P. At the infinitesimal distances considered the tangent t is a close enough definition of said intersection line. The tooth surface of a hypoid gear may be given originally, or also the tooth surface of any one of the basic helical members of the hypoid pair.

Three cases will be considered. The tooth surface first considered is a surface of revolution at the pitch point P, and whose axis is contained in the normal plane and passes through a curvature center C_n, Fig. 28, below or above the pitch plane. It is the same kind of surface that was used in determining angle w.

In Case 1, the said surface of revolution is directly the tooth surface of the gear member of the hypoid gear pair. In Case 2 the said surface of revolution is the tooth surface of a basic helical member, which may be used for generation of the gear pair.

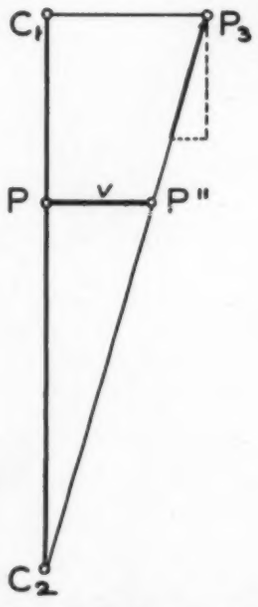


Fig. 29—A diagram used in the derivation

The gear tooth surface is then a modified surface conjugate to said surface of revolution. Case 3 is without restrictions, and applies broadly to any gear tooth surface of a given spiral angle. In all cases the immediate object is to determine the turning displacement about the gear axis, which brings point P' into gear contact.

In Case 1, a force acting along the tooth normal $P'C_n$ at point P', Fig. 28, can be resolved into a vertical component, and into a component in the limit-normal plane in the direction $P'C_e$. The latter component exerts turning moments on the pinion and gear in the proportion of their tooth numbers and continues to do so during infinitesimal turning motions of the gear, because this is the definition of the limit normal and of the limit-normal plane. This component, therefore, does not need to be considered in determining the position of mesh, as it continues to fulfill the condition of contact equally in all considered turning positions of the gear. Only the vertical component needs to be considered.

A vertical unit force exerts an infinitesimal moment dM_p^1 on the pinion, which compares with a moment M_p exerted on the pinion by a unit force applied along the tooth normal at P. Likewise on the gear, moments dM_g^1 and M_g are exerted by a vertical and a normal unit force applied at P' and at P respectively. The moments M_p, M_g are in the ratio of the numbers of teeth of the pinion and the gear.

If P' were a point of contact, then the proportions $\frac{dM_p^1}{M_p}$ and $\frac{dM_g^1}{M_g}$ would have to be equal; and their difference would be zero. When the gear turns even infinitesimally, these proportions change. An increment moment dM_p^2, which depends on the turning position, is added to dM_p^1. An increment moment dM_g^2 is added to dM_g^1. The proportions then become $\frac{dM_p^1 + dM_p^2}{M_p}$ and $\frac{dM_g^1 + dM_g^2}{M_g}$

The position of contact is the position, where these two expressions are equal, and where therefore

$$\left(\frac{dM_p^1}{M_p} - \frac{dM_g^1}{M_g}\right) + \left(\frac{dM_p^2}{M_p} - \frac{dM_g^2}{M_g}\right) = 0$$

The increment moments dM_p^2 and dM_g^2, caused by the displacement of the vertical unit force about the gear axis, can be computed as if the unit force were applied at point P, instead of being applied at point P'

which is at an infinitesimal distance therefrom. These increment moments will be dealt with later.

Fig. 30 is a diagrammatic view of the pitch plane, like Fig. 26. Point P' becomes a point of contact in a position P_2, after a displacement $P'P_2$ about the gear axis. Other points P' at an infinitesimal distance from P move into contact position at other points P_2, which all lie on a line inclined at an angle λ' to the projected pinion axis $O'P$, and at an angle $(\psi_p - \lambda')$ to pitch tangent t. This line is the sought tangent to the line of mesh in the pitch plane.

Inclination of the Normal

As will be shown, ctn $(\psi_p - \lambda')$ can be expressed by formula (25), when the quantity u therein is put down as zero in Case 1.

Case 2 and Case 3 differ from Case 1 in that the normal to the gear tooth surface at point P' is differently inclined. Its inclination to the pitch plane is increased by an infinitesimal angle $d\phi$, and its projection to the pitch plane shows an additional inclination $d\psi$ to the projected tooth normal at P. As a result of these changes, a unit force acting along the gear tooth normal at P' produces an additional moment dM_{p^3} on the pinion and dM_{g^3} on the gear.

A unit force applied at point P' in the direction of the original tooth normal, without the changes $d\phi$ and $d\psi$ of inclination, has a vertical component of $\frac{\sin(\phi - \phi_o)}{\cos\phi_o}$, Fig. 28, when resolved into a vertical component and into a component in the limit-normal plane. The moments dM_{p^1}, dM_{p^2}, dM_{g^1}, dM_{g^2} previously mentioned are based on a vertical unit force. To afford a comparison with the additional moments, the first named moments have to be multiplied by the proportion $\frac{\sin(\phi - \phi_o)}{\cos\phi_o}$ of the vertical component as compared with the previously used vertical unit force. Hence the position of contact in Cases 2 and 3 corresponds to the equation

$$\frac{\sin(\phi-\phi_o)}{\cos\phi_o}\left[\frac{dM_{p^1}+dM_{p^2}}{M_p}\right]+\frac{dM_{p^3}}{M_p}=\frac{\sin(\phi-\phi_o)}{\cos\phi_o}\left[\frac{dM_{g^1}+dM_{g^2}}{M_g}\right]+\frac{dM_{g^3}}{M_g}$$

or also

$$\frac{\sin(\phi-\phi_o)}{\cos\phi_o}\left[\left(\frac{dM_{p^1}}{M_p}-\frac{dM_{g^1}}{M_g}\right)+\left(\frac{dM_{p^2}}{M_p}-\frac{dM_{g^2}}{M_g}\right)\right]+\frac{dM_{p^3}}{M_p}-\frac{dM_{g^3}}{M_g}=0$$

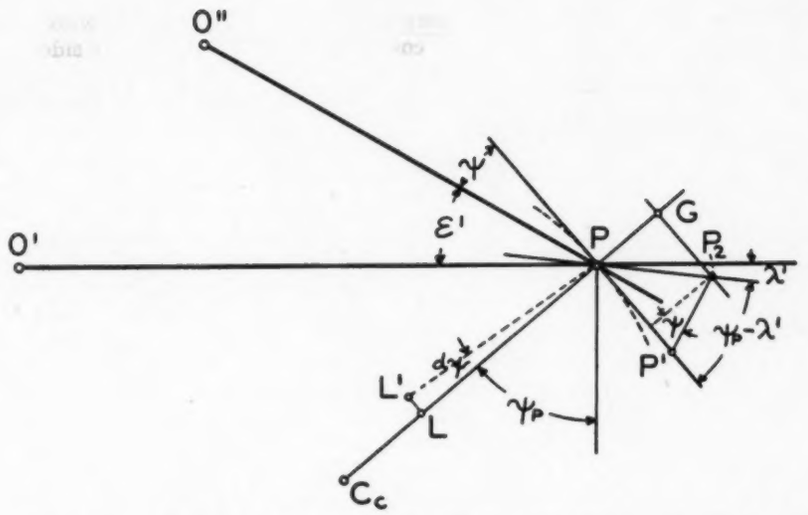


Fig. 30—A view of the pitch plane, like Fig. 26, used in deriving the mesh in the pitch plane. Both sides mesh along a line PP_2 inclined to the projected axes of the gear pair

In Case 2 the gear tooth surface has a relative curvature $\frac{1}{\rho_{wz}}$ with respect to the given tooth surface of the basic member, measured in a plane perpendicular to the line of contact I. In Case 3, the pitch-plane section of the gear tooth surface has a curvature $\frac{1}{r''}+\Delta\frac{1}{r}$, which differs from the curvature $\frac{1}{r''}$ of the described surface of revolution by the term $\Delta\frac{1}{r}$.

The quantity u given in formula (24) hereafter represents the effect of the change of the tooth surface as compared with Case 1, so that with this given quantity formula (25) represents the general solution of the direction of mesh in the pitch plane.

In Case 1, the line of mesh in the pitch plane has the same direction on both sides of the teeth, regardless of their individual pressure angles, which do not appear in the formula (25) in this case. In other words, opposite surfaces of action always intersect in a line tangent to the pitch plane.

This is also true of Case 2, because the item $\frac{\sin^2 w}{\sin(\phi-\phi_o)\,\rho_{wg}}$ in formula (24) can be demonstrated to be equal on both sides, regardless of the individual pressure angles.

In the third case, which is the most general case, the same direction $(\psi_p - \lambda')$ of the line of mesh is obtained on both sides of the teeth when $\frac{\cos\phi}{\sin(\phi-\phi_o)}\,\Delta\frac{1}{r}$ is equal on both sides. $\Delta\frac{1}{r}$ is then opposite in sign, that is plus and minus, inasmuch as $\sin(\phi - \phi_o)$ is also opposite in sign on the two sides. The two surfaces of action therefore can be made to intersect in a line tangent to the pitch-plane, by providing gear teeth whose curvature in the pitch plane section is either $\frac{1}{r''}$ on both sides, or differs from $\frac{1}{r''}$ in opposite direction on the two sides, by definite amounts, so that $\frac{1}{r''}$ is an intermediate value.

It is thus shown that the teeth of described lengthwise curvature are properly made to follow the given taper of the pitch cones. The results justify the author's conception of a center of curvature C_c on the limit normal.

Details of the derivation will now be given.

The moment dM_{p^1} exerted on the pinion by a vertical unit force extending upwardly at P', Fig. 30. amounts to $dM_{p^1} = -PP' \sin\psi_p \cos\gamma = -s \sin\psi_p \cos\gamma$ when s is substituted for PP'.

The minus sign indicates that the vertical force tends to turn the pinion back, opposite to the normal unit force, which exerts a moment $M_p = A_p \sin\gamma \cos\psi_p \cos\phi$ on the pinion. Hence

$$\frac{dM_{p^1}}{M_p} = -\frac{s}{\cos\phi}\,\frac{\tan\psi_p}{A_p\tan\gamma}$$

Likewise on the gear

$$dM_{g^1} = s \sin\psi \cos\Gamma$$
$$M_g = A \sin\Gamma \cos\psi \cos\phi$$
$$\frac{dM_{g^1}}{M_g} = \frac{s}{\cos\phi} \frac{\tan\psi}{A \tan\Gamma}$$

which results in

$$m_1 = \frac{dM_{p^1}}{M_p} - \frac{dM_{g^1}}{M_g} =$$
$$- \frac{s}{\cos\phi}\left(\frac{\tan\psi_p}{A_p \tan\gamma} + \frac{\tan\psi}{A \tan\Gamma}\right)$$

Fig. 29 is a vertical section extending in the peripheral direction of the gear. The axes of the hypoid pair are intersected at points C_1, C_2, whose distances from the pitch plane are $A_p \tan\gamma$, $A \tan\Gamma$. A vertical unit force applied at P exerts no turning moments on the hypoid gears. After it is turned infinitesimally about the gear axis, point P has reached a position P'' at a distance $v = PP''$ from P; and the force is then offset horizontally from point C_1 a distance C_1P_2.

$$C_1P_2 = v \frac{C_1C_2}{PC_2} = v \frac{A \tan\Gamma + A_p \tan\gamma}{A \tan\Gamma}$$

The moment exerted on the pinion by a unit force acting along C_2P_2 is equal to the moment exerted by the vertical component of the unit force applied at point P_2. As angle $C_1C_2P_2$ is infinitesimal, this component is equal to the unit force. The distance of the force from the pinion axis is $C_1P_2 \cos\epsilon'$, and the force component perpendicular to the pinion axis is $\cos\gamma$. The moment dM_{p^2} exerted on the pinion is equal to the product

$$v \frac{A \tan\Gamma + A_p \tan\gamma}{A \tan\Gamma} \cos\epsilon' \cos\gamma.$$ Hence

$$\frac{dM_{p^2}}{M_p} =$$
$$v \frac{A \tan\Gamma + A_p \tan\gamma}{A \tan\Gamma A_p \tan\gamma} \frac{\cos\epsilon'}{\cos\psi_p \cos\phi}$$

No moment is exerted on the gear, $dM_{g^2} = 0$. When the displacement v_n normal to the pitch tangent is introduced, which is equal on the pinion and the gear, $v_n = v \cos\psi$, $v = \frac{v_n}{\cos\psi}$ the term becomes

$$m_2 = \frac{dM_{p^2}}{M_p} - \frac{dM_{g^2}}{M_g} =$$
$$\frac{v_n}{\cos\phi} \frac{A \tan\Gamma + A_p \tan\gamma}{A \tan\Gamma A_p \tan\gamma} \frac{\cos\epsilon'}{\cos\psi_p \cos\psi}$$

In Case 1 the contact position occurs with $m_1 + m_2 = 0$; which results in

$$\frac{v_n}{s} = \frac{\tan\psi_p A \tan\Gamma + \tan\psi A_p \tan\gamma}{A \tan\Gamma + A_p \tan\gamma} \cdot \frac{\cos\psi \cos\psi_p}{\cos\epsilon'}$$

$$\frac{v_n}{s} = \tan(\psi_p - \lambda) \frac{\cos\psi \cos\psi_p}{\cos\epsilon'},$$

see (22)

In Case 2 and Case 3, the effect of the increment inclinations $d\phi$ and $d\psi$ at point P' can be computed as if for point P, which is at an infinitesimal distance s from P'. The change $d\phi$ in pressure angle has the same effect on both the pinion and the gear, and requires no further consideration. An increase $d\psi$ of spiral angle decreases the effective component of a unit force in the proportion of the distances of points L' and L, Fig. 30, from the axial plane $O'P$ of the pinion and from the axial plane $O''P$ of the gear. These distances are on the pinion $PL(\cos\psi_p - d\psi \sin\psi_p)$ and $PL \cos\psi_p$ wherein $d\psi$ is in radian measure. Hence the change dM_{p2} in proportion to the moment M_p amounts to $\frac{dM_{p2}}{M_p} = -\,d\psi \tan\psi_p$ on the pinion, and likewise to $\frac{dM_{g2}}{M_g} = -\,d\psi \tan\psi$ on the gear, the negative sign indicating a decrease in moment.

$$m_3 = \left(\frac{dM_{p2}}{M_p} - \frac{dM_{g2}}{M_g}\right)$$
$$= -\,d\psi\,(\tan\psi_p - \tan\psi)$$

$d\psi$ amounts to $s\,\Delta\frac{1}{r}$ in Case 3, and can be shown to amount to $s\frac{\sin^2 w}{\rho_{wg}\cos\phi}$ in Case 2, where ρ_{wg} is introduced with opposite signs on opposite tooth sides.

The contact equation

$$\frac{\sin(\phi - \phi_o)}{\cos\phi_o}(m_1 + m_2) + m_3 = 0$$

can be transformed into

$$\frac{v_n}{s} - \frac{\cos\psi \cos\psi_p}{\cos\epsilon'}\Big[\tan(\psi_p - \lambda)$$
$$+ \frac{A \tan\Gamma A_p \tan\gamma}{A \tan\Gamma + A_p \tan\gamma} \frac{\cos\phi_o \cos\phi}{\sin(\phi - \phi_o)} \frac{d\psi}{s}$$
$$\cdot\,(\tan\psi_p - \tan\psi)\Big] = 0$$

Use u for the second term

$$(24)\quad u = \frac{A \tan\Gamma A_p \tan\gamma}{A \tan\Gamma + A_p \tan\gamma} \cdot$$
$$\frac{\cos\phi_o}{\sin(\phi - \phi_o)} \frac{\sin^2 w}{\rho_{wg}} (\tan\psi_p - \tan\psi)$$

$$u = \frac{A \tan\Gamma A_p \tan\gamma}{A \tan\Gamma + A_p \tan\gamma} \frac{\cos\phi_o \cos\phi}{\sin(\phi - \phi_o)} \cdot$$
$$\Delta \frac{1}{r} (\tan\psi_p - \tan\psi)$$

$$\frac{v_n}{s} = \frac{\cos\psi \cos\psi_p}{\cos\epsilon'}\Big[\tan(\psi_p - \lambda) + u\Big]$$

From Fig. 30, $P'P_2 \cos\psi = v_n$

$$\operatorname{ctn}(\psi_p - \lambda') = \frac{s - v_n \tan\psi}{v_n}$$
$$= \frac{s}{v_n} - \tan\psi$$

$$(25)\quad \operatorname{ctn}(\psi_p - \lambda') =$$
$$\frac{\cos\epsilon'}{\cos\psi \cos\psi_p [\tan(\psi_p - \lambda) + u]} - \tan\psi$$

SEEN and HEARD

JOHN R. GODFREY

Safe Use of Solvents

Employees assigned to work involving exposure to solvents should be in good general physical condition. Authorities rule out such tasks for persons with arrested tuberculosis, diabetes, heart disorders or other chronic illnesses.

Recent medical reports indicate nutrition is important to individual susceptibilty to solvent poisoning. A person on a poorly balanced diet may lack normal resistance to the effects of solvent vapors. Alcoholism likewise encourages solvent poisoning. Every employee subject to prolonged exposure to organic solvent vapors, even in low concentrations, should have frequent physical examinations.

Ground Surface Plates

I AM SEEING more and more surface plates of marble or granite. Most shops seem to like them as well as cast iron for most work. I've been told the Corning Glass Co. plans to put out glass surface plates and glass plug and ring gages.

There is more controversy over gages than over surface plates. Some claim glass outwears steel while others say their experience is just the reverse of this.

What interests me particularly about the stone surface plates is they are all finished by grinding, while all the cast iron plates I've seen are scraped, or at least spotted.

The stone plate makers guarantee accuracy within very close limits and there seems to be no good reason why cast-iron plates cannot be finished in the same way. It's hard for men to believe that a man with a scraper can make a flatter surface than a good grinder can produce.

ROUND TABLE

Can Work Be A Picnic?

"Do you actually believe your Missus would get a kick out of seeing you go around checking time slips," asked Ed across the lunch table, "or are you just figuring on showing yourself off to the town?"

"You never get tired of that sourpuss act, do you, Ed? Making out like you wouldn't get a big bat out of having your wife and daughters see where you get the dough for their bread!"

"I'm not making out like I wouldn't, Al. *I wouldn't!* Bringing a batch of squealy females into the plant wouldn't only mess up a day, but I'd never hear the last of the remarks about the 'dirty old machines', and the 'awful noise', and Lord knows what else. If any of my family wants to know anything about this place, I'll tell 'em. None of 'em have ever shown much interest so far, except when they thought we was makin' secret stuff during the war. There's nobody with more itch to learn somebody else's business than a woman."

"Well, why not give 'em their fill for once, then, Ed? Let 'em see where you spend most of your time—then maybe they'll appreciate why you come home grumpy some days, worn to a frazzle others, and happy as a bug once in a while. It might give you something to talk about with 'em, instead of stuffing your face while they talk hats."

"There's plenty to talk about if I feel like talkin', Al, and I'm no Gabby Gus like you. When I get away from this place, I want to leave it behind, not go hashing over the whole day with females. First thing you know, I'll have to listen to stories about how sore their knees are from scrubbing the kitchen and how much darning they had to do on my socks."

"Now it's self-defense, eh? Why don't you just let your family stay home? After all, this idea of a Family Day was for the boys to show their families around, not for us."

"Yeah, let my family stay home! They'd hear about the shindig within 24 hours. Then my name would be mud for not havin' 'em come too."

"It's Hell if you do and Hell if you don't, eh, Ed? Just can't seem to keep yourself out of hot water. But it isn't you and your troubles that's important—it's the boys. They want to show off how good they are—show what they've been doing that helped win the war and maybe the peace. Most of 'em don't have any service ribbons or medals, you know. Besides, I think a chance to stick out their chests will make 'em feel a lot better about the plant, make 'em more interested in what they're doing—maybe even cut down the absentee rate."

"And maybe increase it after their wives and best girls see how hard the poor boy friend has to work! Your boys put you up to this, I'll bet, Al, just to show off their fancy-painted machines and lord it over the rest of the plant."

"Beginning to think you ought to paint up the toolroom, too, eh? Feeling a little behind the times or something, eh?"

"No, I'm not! But, by George, there's some reason behind this idea of yours besides what you admit, and I want to find out what it is. Maybe you're goin' soft in the head—next you'll be starting up the idea of an annual picnic again."

"By golly, Ed, you've got an idea there! Now that the war pressure's off, we could have a dinger! No gas rations, so we can go out to Black Rock: swimming, soft ball, plenty of beer and ice cream. . . "

***SHOULD FAMILIES** know what shops are like? Does it help if they do? Your experiences or opinions are interesting to other readers. Discussions on earlier topics appear in later pages.*

Capacitance

CAPACITANCE permits temporary storage of electric energy for future return to the circuit. All circuits have some capacitance, but we can build devices to increase this effect.

Capacitors should not be confused with batteries, which convert electric energy to chemical energy for storage. In capacitors, electrons are actually trapped and held until needed. Sometimes capacitors are called condensers, but they are one and the same thing.

A simple capacitor is made up of two conductor plates separated by a dielectric, which is an insulator. The plates are of good conducting material such as copper or aluminum. The dielectric may be air, a thin sheet of mica, wax paper, or paper soaked in either oil or a special liquid. The area of the plates, the distance between them, and the type of dielectric used, all these determine the storage ability of a capacitor, that is its ability to trap electrons.

How Capacitors Operate

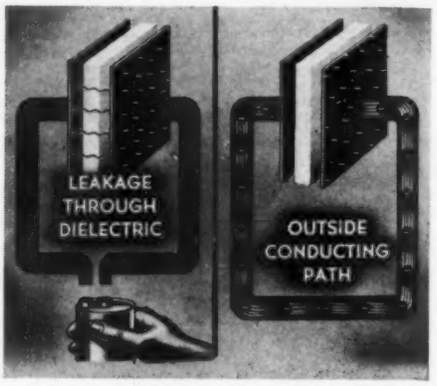
The basic operation of a capacitor is simple. When a d.c. voltage is applied across the two plates, electrons are drawn from the plate of the capacitor which is connected to the positive side of the battery, through the battery to the plate connected to the negative side of the battery. Thus an unbalance is created and the plates, attempting to neutralize themselves, set up a stress in the dielectric. A capacitor is then said to be "charged."

If we remove the d.c. supply, we leave an excess of trapped electrons on one plate and an equal lack of electrons on the other plate.

From this action, we can see that in capacitance, the energy stored is a result of the voltage or electric pressure, which piles up electrons on one plate and causes a stress in the dielectric between the plates, just as energy, stored in a spring, is the result of pressure used to compress the spring.

The stored energy in a capacitor will remain indefinitely unless it leaks through the dielectric or is released for use through an outside conducting path. If such an outside conducting path has low resistance, there is large electron flow. The voltage between the plates rapidly disappears as the stored energy is converted into heat in the circuit resistance, until finally the capacitor is totally discharged, and electrical balance is regained. However, if the outside path has high resistance, electron flow will be less, the voltage will fall slower, and energy will be converted into heat at a lower rate. Thus, the same electric energy requires a longer time to be converted into heat.

In superspeed photography, which makes use of an electronic photolight, we discharge the capacitor through the low resistance of the lamp. The energy released gives an extremely brilliant flash. This flash, lasting only four-one-millionths of a second, permits us to take such pictures as a laboratory snapshot of a supercharger rotor, flying apart at the terrific overspeed of 40,000 revolutions a minute.



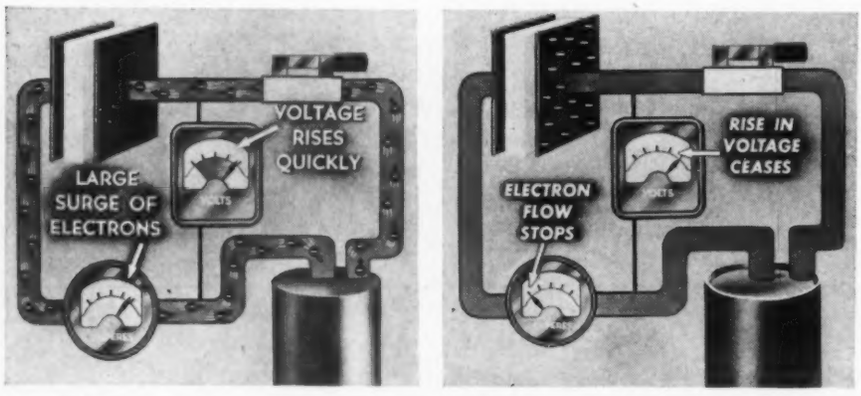
A capacitor will discharge only through a leak in the dielectric or through an outside conductor

In timing industrial processes such as induction heating, we discharge a capacitor through a high resistance and use the slow, accurate voltage change as a means for timing.

Thus we see that in capacitance a high circuit resistance results in a slow voltage change and low current flow; a low resistance causes rapid voltage change and high current flow. If, for example, we connect a battery to a discharged capacitor, the voltage across the capacitor must rise quickly to the battery voltage. This requires a large surge of electrons. As the rise in voltage ceases, the electron flow stops. Therefore, we say that electron flow is always directly proportional to the speed of rise and fall of the voltage.

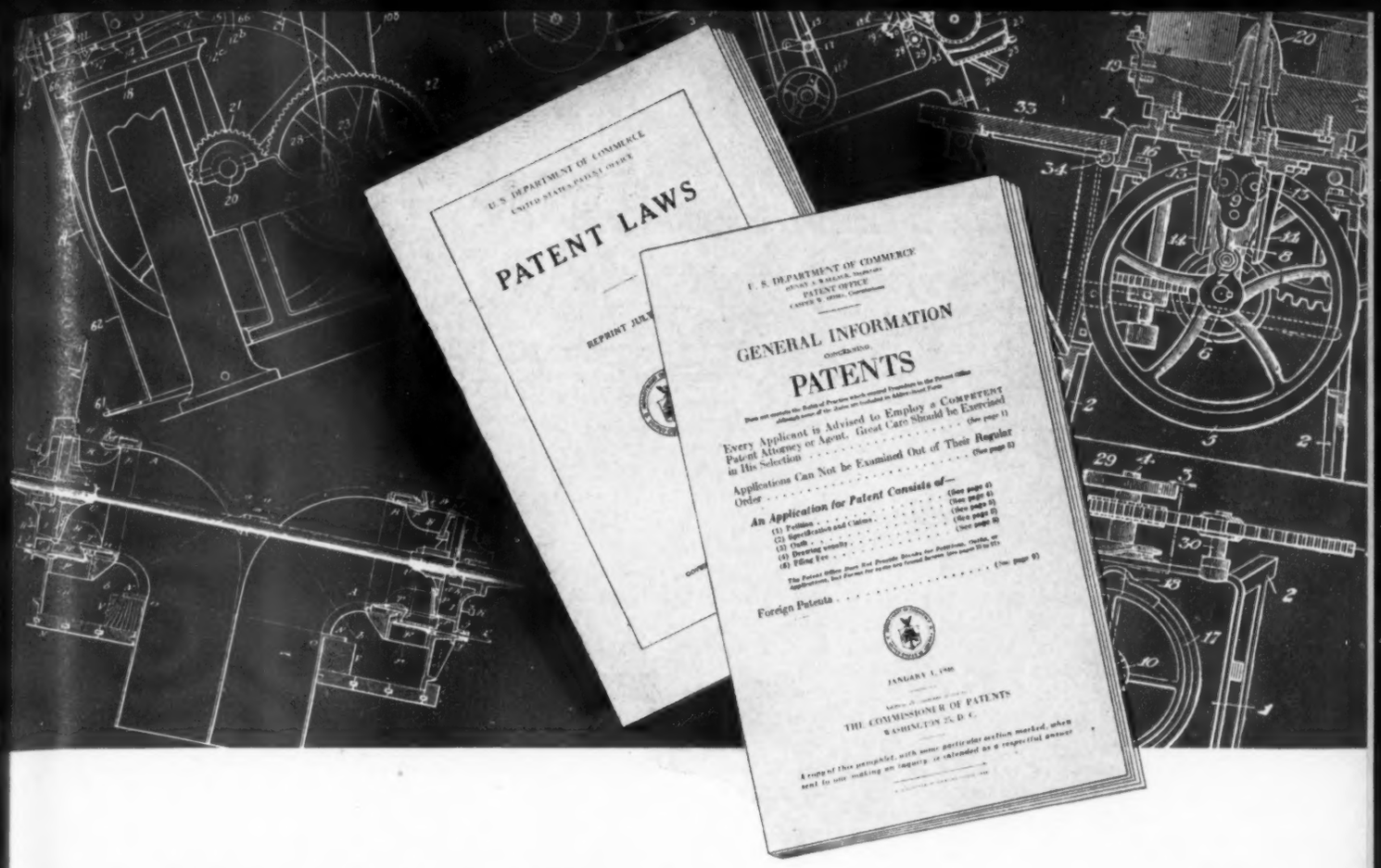
No Current Flows Through

It is important to remember at all times that there is no appreciable flow through a capacitor, whether connected to d.c. or a.c. Electrons merely flow or surge in and out, back and forth, from one plate to another by means of an outside circuit. Therefore with a.c., electrons surge back and forth, to and from the plates as many times as the voltage changes direction. Here, obviously the capacitor charges, discharges, and recharges in the opposite direction with each succeeding reversal of voltage. Thus alternating current creates the illusion that current flows through a capacitor. But this illusion is contrary to fact.



In a capacitor current flow is proportional to the rate of change of voltage

Based on a sound slide film in the General Electric industrial electronics course.


U. S. DEPARTMENT OF COMMERCE
PATENT LAWS
U. S. DEPARTMENT OF COMMERCE
PATENT OFFICE
GENERAL INFORMATION
PATENTS
Every Applicant is Advised to Employ a Competent Patent Attorney or Agent. Great Care Should be Exercised in His Selection
Applications Can Not be Examined Out of Their Regular Order
An Application for Patent Consists of—
Foreign Patents
JANUARY 1, 1946
THE COMMISSIONER OF PATENTS
WASHINGTON 25, D. C.

PATENTS...

How To Get Them, Use Them and Protect the Rights They Provide

BY BENJAMIN W. CORRADO

ASSOCIATE EDITOR

WITH so many new products planned, postwar patent applications have deluged the U. S. Patent Office. Patent ownership and patent rights have assumed evergrowing importance, as metalworking plants strive to achieve new peacetime production records. Moreover, many companies planning to enter new fields are willing to sell or license some of their patents, while former war subcontractors are seeking patent privileges to manufacture peacetime products. Many businessmen are eyeing incentives to encourage patent development by employees.

Despite this great interest in our patent system, it is now threatened with radical changes by proposed or pending legislation that would affect every patent holder, licensee, inventor, and business operating under patent rights. Even private research and development work is endangered.

A discussion of useful patent information and major dangers facing our patent system is presented in this report, along with sound suggestions for improving and streamlining our patent system.

★ AN American Machinist REPORT TO THE METALWORKING INDUSTRIES ★

ANNUAL ISSUANCE OF PATENTS

Unless Patent Office bottleneck is broken and threatening legislation is blocked, inventors and patent users face delays and discouragement

IF YOU want to patent a new invention today, it may take you at least two years to get your patent, because of the serious bottleneck in the U. S. Patent Office. And by the time you get your patent, its value may be substantially impaired by the passage of legislation now before Congress or to be introduced by those seeking to change our patent system. Despite this discouraging prospect, there are means at hand for improving and streamlining our patent system provided that industry supports them.

As now constituted, our patent system offers the patent holder an exclusive right to his discovery for 17 years, during which time he can exploit his invention without worrying about competitors copying his idea and using it commercially. At the end of 17 years, the invention becomes public property and may be used freely by anyone.

Under this protective system (with minor changes since its inception), almost 2,500,000 inventions have been patented since 1790. The number of patents issued annually by the Patent Office reached its all-time peak of 55,709 in 1932, since which fiscal year as a result of depression and the war annual issuances fell off gradually to 31,033 in 1945, the lowest number since 1902.

The wartime decline in new patents is largely attributed to the diversion of many of our scientists to perfecting various instruments of war. At the same time, inventors of peacetime products probably held back patenting, because they would be unable to use the patent until the war was over anyway.

But despite the heavy rise in patent applications since the end of the war, industry is concerned over the inability of the present staff of the U. S. Patent Office to handle them rapidly enough. Right now, the Office has 550 examiners, aided by some 75 professional workers, who may be able to process about 50,000 patent applications this year out of the 110,000 cases pending. The Office needs at least 400 more full-fledged examiners to enable it to catch up on its work and speed the handling of future applications, although streamlined practices introduced by the new Patent Commissioner, Casper W. Ooms, have eliminated one-third of the work required on applications. (One example of this streamlining is the new single-signature patent application form, which reduces checking in the Patent Office.)

Enlargement of the staff of the Patent Office would also bring other benefits to inventors and patent users. A bigger staff could make more extensive searches of prior patents to insure greater validity of every new patent issued, and afford patent holders greater protection against litigation. Moreover, this sounder basis for new patents would tend to reduce the volume of patent litigation, which is often a great financial burden to the inventor and the company using his patent.

If better salaries were also offered for Examiners, the best personnel available could be secured to perform this important work. With more and better personnel, the Office could set more rules governing the examination of applications further to safeguard new patents.

The U. S. Patent Office is a relatively small operation in the multi-billion

HOW TO GET PATENT INFORMATION

1 *You, or your representative, can examine existing patents in any particular field. They are carefully indexed by subject in the U. S. Patent Office Search Room, Commerce Building, Washington, D. C., or in public Libraries in major cities, such as New York and Chicago.*

2 *You may secure copies of any existing patent from the U. S. Patent Office at 10¢ per copy. If you are interested in all patents in a particular field, you can ask the Patent Office to send you a "class list" on the subject, then select and order copies of the patents you want.*

3 *If you seek rights to manufacture patented products, you can examine the U. S. Patent Office Register of Patents Available for Sale or License, and you can be placed on the mailing list of the Office to be advised of additional patents placed on the register.*

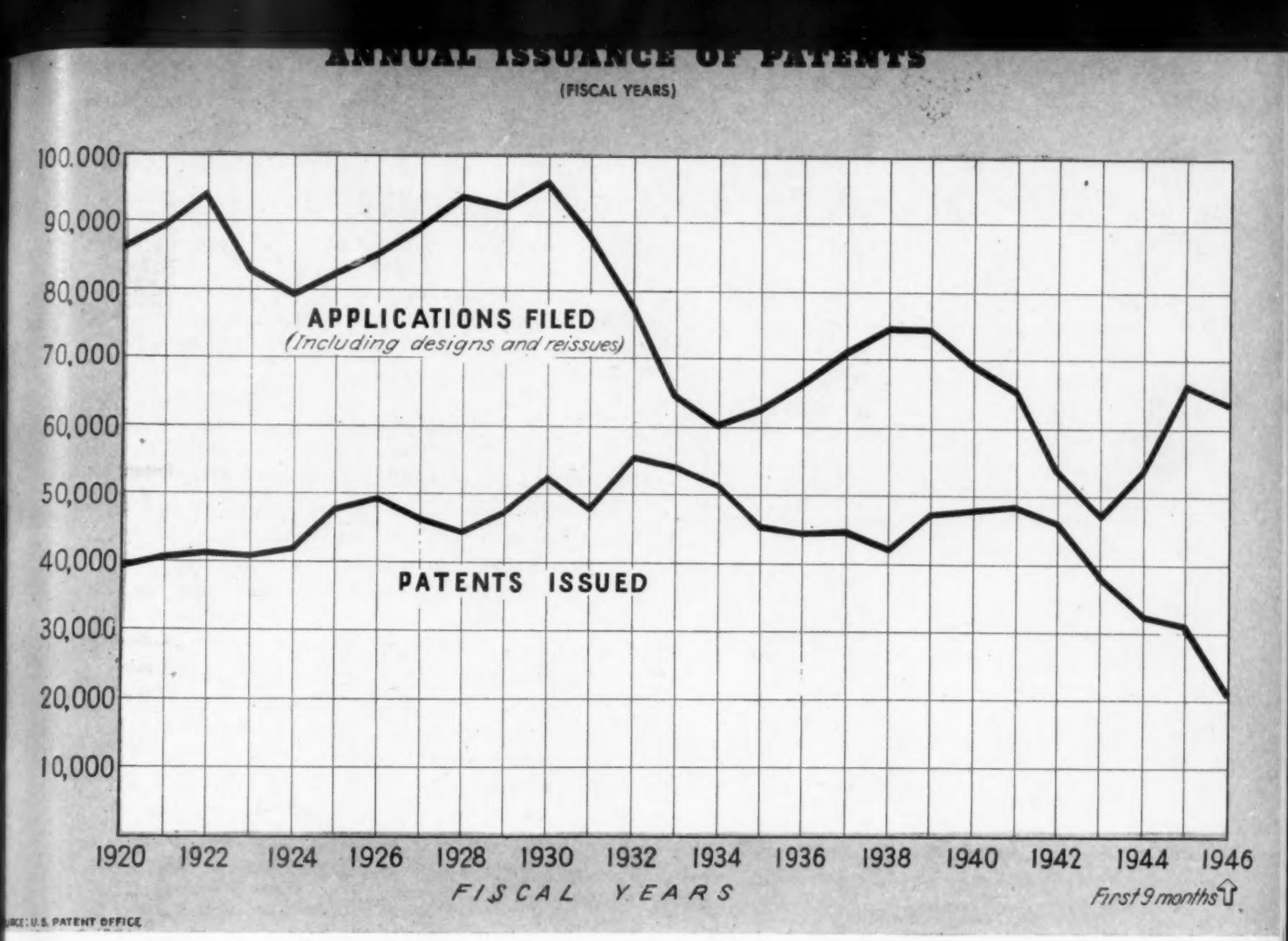
4 *You may subscribe to the weekly Gazette of the U. S. Patent Office ($16 yearly, secured through the Superintendent of Documents, Washington, D. C.), which lists newly issued patents, design patents trademarks, legal decisions affecting patents additions to the register of patents available for licensing and sale, new rulings of the U. S. Patent Office, and so on.*

5 *Expiring patents, which can be used by anyone without obligation, are currently listed in the weekly publication, "Public Domain," published by the Scientific Development Corp., 614 West 49th St., New York 19 N. Y.*

6 *Basic patent information can be secured from the U. S. Patent Office, Dept. of Commerce, Washington.*

7 *Information on 45,000 seized foreign patents may be obtained from the Midwest Research Institute, Kansas City, Mo., the repository for patents held by the Alien Property Custodian. Fees charged by the Alien Property Custodian for use of an enemy patent for its life are $15. Patents owned by formerly occupied countries may be used for the same fee, but such use is limited for the duration of the war and six months, after which a small royalty of about 1% is charged.*

8 *Information on hundreds of thousands of foreign patents is kept on file at the U. S. Patent Office, and is available for inspection.*



government budget, and is one of the few Federal units which normally do not operate at a deficit. The proposal to increase its staff would not increase government expenditures, because it would enable the processing of more patent applications, which would help increase its patent revenue.

Helping to Exploit Patents

Despite its operating handicaps, the Patent Office in June, 1945, established a register, where patent holders wishing to license or sell their patents could have them listed gratis, and where those seeking to purchase patent rights could go. Thus far, more than 11,000 patents have been listed on this Register of Patents Available for Licensing or Sale, including all of the patents of the Radio Corporation of America, and about 1,200 patents of the International Harvester Company. International Harvester has prepared a booklet digesting these patents, and copies may be obtained from the company headquarters in Chicago, Ill.

To utilize this service, the patent owner merely sends a copy of his patent to the U. S. Patent Office, requests that it be registered, and states that he will either grant license or sell his patent. He does not have to state the exact terms under which he will grant licenses.

Any person seeking new patented products for manufacture, can secure from the Patent Office lists of patents on the Register in the field in which he is interested. Interested persons may also watch the weekly issues of the Official Gazette of the Patent Office, where new additions to the register are reported in brief, simple language, along with the patent owner's name and address. Copies of any patent may be purchased from the U. S. Patent Office at 10c each, and millions are sold annually. In 1945, over 300,000 copies were sold to Soviet Russia.

In 1945, a bill was introduced in Congress (H.R.2630, revised in H.R. 3757) providing for a public register of patents, such as this. However, the law also provided that the Commissioner of Patents should have the power to fix the terms and conditions of licenses listed on the register, which was opposed by industry on the grounds that the patent owner and patent licensee should be left free to negotiate their own terms. It is further reported that the Patent Office is not anxious to take on such additional work. But the bill is still before Congress.

Besides trying to speed up the processing and utilization of patents, the Patent Office has been studying means to minimize patent litigation. One step Patent Commissioner Ooms has suggested is the publishing of patent applications (with safeguards to protect the inventor against piracy of his idea), which would help bring to the attention of the Patent Office any prior patent that the Office might not have noticed in its search of earlier records. The danger of this plan is that earlier inventors may attack new patent applications in their fields without adequate justification more often than not, and thus delay the issuance of patents, increase the number of "interference" cases, and tie up the Patent Office hopelessly. At present, the Patent Office does not give out any information on pending patents.

Mr. Ooms has further suggested that in order to help reduce the expense and delay of patent litigation,

How to Get a Patent

Filing of a patent application is an involved procedure, so the Patent Office recommends that the inventor employ a competent patent attorney or agent registered with the U. S. Patent Office. Unless the attorney or agent is so registered, he is not permitted to handle the patent application.

The first step, *before* the patent application is filed with the Patent Office, is the *search* of Patent Office records to determine whether or not a similar invention has already been patented by someone else. The inventor or his attorney may search the record of patents, filed by subject matter to permit easier examination. A thorough search of the records will help speed the patent application, and may save the inventor the expense of applying for a patent which will not be granted.

Filing the Application

Upon being reasonably assured that his invention does not infringe on prior claims, the inventor can proceed with his patent *application*. This consists of a filing fee of $30, a petition for the patent, specifications, claims, an oath and a drawing when needed. The *petition* must be addressed to the Commissioner of Patents, stating the name and address of the inventor, the title of the invention, and must have the inventor's signature.

The *specification* is the written description of the invention and how it is used. It should be clear, concise, and complete, and must be in exact terms to enable any skilled person to understand it. If the invention is a mere improvement, the specification should point out which parts are new and which are old, and the description and drawings should be confined to these innovations.

Describing the Invention

The inventor must list the specific *claim* or claims he is making, for his invention. The inventor must also take an *oath* that he believes himself to be the original inventor.

When required, a *drawing* should be furnished, showing every feature of the invention, on 10x15-in. sheets, drawn in India ink. The applicant should have a competent draftstman make his drawings, or send the required drawings to the Patent Office, which will prepare them at cost.

When two inventors apply for a patent on the same invention, the Patent Office declares an *"interference."* Each applicant then submits his testimony so the Patent Office may decide which one made the invention first and grant him the patent, regardless of which applicant submitted the earlier application.

Countering a Rejection

If the patent application is *rejected*, the Patent Office will give its reason for rejection. The applicant then may amend his application in the light of the rejection. Either with or without such alteration, the inventor may persist in his claim and have the application reexamined. However, if he does not answer any rejection within six months, then the Patent Office will abandon the application. Applicants should keep copies of their applications, because papers will not be returned, whether or not the patent is granted.

If the patent examiner refuses to grant the patent, the inventor may take his case to the Patent Office Board of Appeals, and then to the Court of Customs and Patent Appeals or to the U. S. District Court for the District of Columbia, from which he may appeal to the Circuit Court of Appeals.

When the patent application is approved, the inventor is sent a *notice of allowance*, after which he must pay his final fee of $30 within six months. The patent is delivered or mailed on the date issued.

Transferring the Patent

The inventor can transfer his whole interest in the patent, while the patent is pending, through an *assignment*. The patent would then be issued to the assignee. A *grant* conveys the exclusive right, under the patent, to make, use, and sell the patented article throughout some part of the United States excluding the patent holder therefrom. A *license* is merely a permission to use the patent under certain conditions and for certain fees or royalties. The registration of assignments, grants, or licenses in the U. S. Patent Office, assures the legal standing of the arrangement, affording protection against subsequent changes of mind by either party.

The Patent Office cannot advise in advance whether or not an inventor should apply for a patent, or make searches for him before the application has actually been filed. No patent can be issued for a device that is not operative and is not clearly set forth to prove it capable of manufacture. No patent is granted upon a mere idea or suggestion.

the trial judges could be greatly aided by assigning them experts to pass on technical questions. On the other hand, some patent judges and lawyers have suggested that perhaps patent Examiners should sit through some patent litigation to appreciate fully the questions of validity involved, so their issuance of future patents would stand up in court in the event of challenge by a prior patent holder. Other observers have contended that patent cases should only be brought before judges with specialized experience in this field. Actually, all patent litigation is not necessarily expensive and protracted despite the wide publicity given to extended cases.

The suggestion that cases involved in patent litigation be sent back to the Patent Office for determination is opposed by Commissioner Ooms, who points out that the Office is not equipped to handle such cases, and then, too, the objective consideration of the validity of the patent in question might be prevented by the desire to approve the challenged patent issued by the Office. The Patent Office feels that it has exercised its responsibility in patent matters when it has carefully searched prior patents and records to ascertain that the invention application represents a new patentable unit. If another inventor feels that the patent infringes on his own rights, then it becomes a matter for the courts to decide.

As there are many fine shades of difference between patents and processes to be decided upon in patent litigation, it is apparent that no easy solution is available that would be completely foolproof against litigation. However, industry has shown increasing concern over the growing number of patents disallowed by Federal courts in litigation over recent years. This is reported to have caused reluctance on the part of some large companies to apply for new patents.

The Inventor's Problems

Trying to get his patent successfully out of the Patent Office and hoping to stay clear of litigation are only two of the inventor's headaches. He is constantly concerned with fears that his invention will be stolen, must worry about the cost of the patent and the possibility that it may unintentionally infringe on other patents, and when he has his patent he must then try to market it.

In their desire for secrecy, inventors often fail to keep written records of their progress on their work, and in some cases have been adjudged as not having been the original inventor because of lack of such records. In order to protect his invention prior to filing his patent application, it is recommended that the inventor: (a) make a sketch and written description of the invention and date it; (b) have the sketch and description witnessed (signed and dated by two or more witnesses); (c) continue working on the invention until the actual application is made or until a working model has been built or an actual model has been placed in operation. He should save all papers and documents, carefully dated, in connection with his invention.

If the inventor conceives an idea but lays it aside for several years, and another inventor comes along with the same idea, but works on it, develops it, then applies for a patent, he may well be adjudged the legal inventor. The reason is that under the law "invention" is the conception on an idea *and* the reducing of it to practice.

Another precaution the inventor must make is to apply for his patent *within one year* from the first public use or sale of the invention. One excuse frequently given for applying for a patent after the stated interval is that it has been in "experimental" use during that period. But this must be proved by the inventor.

Under the law, an employee hired to invent must turn over to his employer patent rights to any invention he may develop. *But an employee hired for general work is entitled to any invention he may make and the patents he may obtain for them.* In the absence of written agreement to the contrary, these are the general conditions upheld by the law.

In cases where an employee uses the employer's time and material to perfect and develop an invention, and permits the employer to use it, then it is implied that the employer may use the invention, even if the inventor severs his connection with the employer's company. In the case of machines, the implied "shop rights" only cover the specific machines built and used in connection with the invention. If the employer makes the item for sale with the inventor's knowledge and consent, then the employer is implied to have a license to make and sell the product and cannot be stopped later by the inventor. The inventor's protection in such cases is that he is free to license and sell the invention to others, so his employer has an important stake in coming to a definite agreement with the inventor.

Upon securing his patent, the inventor has the right to: (a) fix a royalty to be paid him on the productive use of his invention; (b) set a sales price for the manufactured product, but not its resale price; (c) limit the number of articles the licensee may make, use or sell; (d)

The inventor fears he will not be amply paid or his invention will be stolen. The manufacturer must establish its real worth

limit the territory of the licensee of the invention; (e) limit the purpose or field of use of the invention.

These rights assume value only to the extent of the inventor's ability to market his idea, the terms of his agreement with the user of the patent, and the relative volume of demand for his invention that may be developed. Despite this, most inventors feel that their patent is worth at least a million dollars, even though less than 5% of all patents granted are used commercially later on.

This attitude of the inventor points up the powerful incentive to him provided by the 17-year monopoly over his patent granted under the present patent law. Robert E. Wilson, Chairman of the Board, Standard Oil Co. of Indiana, said: "Whoever first conceived the notion of granting the inventor a limited monopoly in return for public disclosure of his invention had a brilliant idea, because it takes advantage of the fact that every inventor tends to overvalue his own invention. No reasonable cash sum would encourage him as much as the thought of being able to control his invention for a period of seventeen years. It is difficult to think of a fairer method of reward, because its magnitude is largely dependent on how important the invention turns out to be and on the amount of intelligence the inventor uses in handling his patent."

When an inventor sells his patent on a royalty basis, he should excercise care to make sure that the purchaser will push his invention and make and sell as many as possible. If he does not, he may sell his patent for a high percentage royalty, but actually collect small cash royalties because production may be held back for any one of various reasons. If, for example, the buyer owns a similar patent, he may elect to hold the inventor's product off the market until he has written off his present equipment and is ready to buy new equipment to launch the new product.

The inventor's only safeguard in leasing his patent rights on a royalty basis is his contract. Because of this, the inventor should strive to make written provisions in it to assure that production of the article will be started within a certain period of time, that the manufacturer will invest the requisite sums to begin manufacture, and that bona fide attempts will be made to push sales.

Patenting an invention costs the inventor a minimum of $200, and usually around $500, to cover legal fees, filing fees, draftsman's fee, and so on. This relatively low cost is accessible to practically all small inventors and small plants. For example, in 1938, a U. S. Patent Office survey showed that 42.9% of the patents issued were assigned to individuals, 34.5% went to small firms, 5.4% went to foreign corporations, and 17.2% went to large corporations with assets of over $50,000,000.

The Manufacturer's Problem

Few inventors fully appreciate the manufacturer's problem in negotiating the sale or license of a patent. The manufacturer must be prepared to make a special investment in equipment in many cases, he must advertise and market the product to assure favorable sales, and he appreciates that his competitors will strive to produce a better product as soon as this new product is on the market. Then again, the manufacturer realizes that: (a) at any time, litigation may be brought up challenging the validity of the patent, which might prove costly in time and money; (b) he knows that if the patent should be declared void at some future date, he might lose his entire investment in the invention.

Despite these uncertainties, the manufacturer must be on the alert for new developments in his field to assure the maintenance of his competitive position. This generally leaves him open-minded in the purchase or license of new inventions in his field. Moreover, it is the basic reason for the bulk of industrial research carried on in plants and laboratories.

This attitude necessitates that he also consider patent ideas or unpatented inventions brought to his attention by outside inventors. Frequently, such inventions require further improvement before patenting, and such work could be better done in the plant of the manufacturer. Under such circumstances, a written agreement should be made with the inventor to cover the disclosure of the invention during the experimental work and during the subsequent search of prior patents before applying for a patent on it. The absence of such agreements has caused almost endless claims of thievery and litiga-

HOW TO GET MORE USE FROM YOUR PATENTS

1 You may list them with the U. S. Patent Office Register of Patents Available for Sale or Licensing on a royalty basis.

2 You may exchange patent rights with holders of patents in the same field, thus secure the mutual benefits of each other's patents. This is known as cross-licensing. You can locate holders of patents in the same field and details of their patents by searching the records of the U. S. Patent Office.

3 To approach directly potential purchasers or licensors of your patent, you could begin by culling prospective candidates from the list of patent holders in the same or similar fields, as indicated by U. S. Patent Office records.

4 You may also exchange patent rights with holders of foreign patents in the same field, or sell patent rights in various foreign countries. Before making an application for a foreign patent, it is usually desirable to ascertain from the Patent Office that the U. S. patent will be granted, because a patent application in most foreign countries may be filed within 12 months of the U. S. filing date, with the same rights as if filed on the day of application in the U. S. In most foreign countries, taxes on patents are payable annually, in addition to the filing fee, and use of the patent must be made within a specified period, after which the patent is subject to compulsory licensing.

5 Frequently, professional patent promoters can market patent rights more successfully than the original owners.

tion—so much that some companies refuse to examine an idea until a patent application has been made.

The manufacturer should also make sure that there are not basic patents, held by others, which would block the use of the invention offered to him for sale. If there are such basic patents, he might investigate their possible licensing to permit him to use the new invention offered to him.

In arranging for the license or purchase of a patent, the manufacturer considers these various factors in making offers for such privileges. If he has a small plant, it often is to his advantage to take area rights to the patent at a lower price, and permit the inventor to sell similar rights in other areas. He must also consider that the immediate cash offer to the inventor (usually plus subsequent royalties) is a powerful factor in closing such arrangements.

Various other incentives can be offered to the inventor in the form of assurances of prompt production of the item, promotion of a large volume of sales, participation of the inventor in further development of his product, and so on. The manufacturer often seeks incentives for himself in the form of a declining royalty rate as the volume of sales increases. Such provisions are generally acceptable to inventors, as the patent holder appreciates that the manufacturer will try to push sales to increase his own profit margin, which only serves to increase the inventor's total return despite a declining royalty rate.

Though the inventor always tends to overvalue his brain-child, the manufacturer generally realizes that if he does not make a satisfactory arrangement with the patent holder, then the latter may take future patents in the same or other fields to other manufacturers.

Rewarding Employees For Patentable Ideas

The development of successful company policies for rewarding employees who come forward with patentable ideas has been a rather difficult job for many managements. Because of the many problems involved, there is no universal practice along these lines in industry today. However, some progress has been made in establishing sound systems for encouraging employees to take their patent ideas to their company, and in providing adequate rewards therefor.

Although many patents have been purchased from outsiders by various companies at royalties averaging 5% of the selling price of the new product, the extension of this practice to company employees would soon make royalty payments prohibitive. For example, a manufacturer with profits of 20% before royalties and taxes, would find his profits wiped out if he purchased four patents from employees at the 5% rate. As a result, many companies have offered smaller percentage royalties for employees' patent ideas (usually about 25% of normal rate to outsiders), while others have preferred a flat cash payment basis.

There are numerous employee patent incentive plans similar to that instituted by the Ryan Aeronautical Co. during the war. This company provided special facilities and funds to determine the merit of patentable ideas, to handle the patent, to conduct research and development work, and to make business contacts for licensing the patent.

Basis of the Ryan plan was an invention agreement, required of employees working directly on design or development, but available to other employees with patentable ideas. When employees covered by the agreement have invention ideas, they file a "Disclosure of Invention" form with the company patent department, listing the inventor or inventors, date of conception, to whom the idea has been disclosed, when and where filed or applied, and a description and drawing of the invention. This form is witnessed and held in confidence by the patent department, which acts as patent attorneys.

Each disclosure form receives a docket number. If the patent department feels the invention is of interest to the company and is patentable, a preliminary patent search is made, and within nine months of the disclosure date the inventor is notified either that the company is not interested, that the idea is not patentable, or that a patent application is being prepared.

If the idea is returned, the company retains only a "free shop right." If it is patentable, the inventor is paid $5 upon signing the application, plus $10 when the patent is issued. The company pays all costs in connection with securing the patent. If, thereafter, a third party is licensed or is sold the patent, the inventor receives a percentage of the return —30% of the first $1,000, 25% of the second $1,000, and 20% of all sums over that, paid quarterly.

Most companies pay the expense of investigating and securing the patents for research employees. But the Ryan plan also offers to do this for non-research employees, in return for plant rights and the major part of outside licensing or sale royalties. The Ryan plan is also unusual in that it

SOME EMPLOYEE PATENT AND RESEARCH INCENTIVES

In a recent survey of payment for employee inventions, The National Industrial Conference Board reported that 65 out of 81 companies do not pay employees on a percentage basis, preferring instead a bonus, a wage increase or a promotion as a form of reward. Fourteen companies grant a percentage of the patent income as follows:

NO. OF COMPANIES	EMPLOYEE PATENT COMPENSATION
1	1/10 of 1% of sales price payable quarterly.
3	10% of net savings to company.
1	30% on first $1,000; 25% on next $2,000; 20% thereafter.
1	10% up to $5,000; 5% on next $5,000; 2½% on next $10,000; 1% thereafter.
1	10% of first year's net savings or 5% of gross savings, whichever is greater.
1	80% up to $20,000 and 9% thereafter.
1	50% on sale of patent rights.
4	Percentage awarded, but no details available.

Rewards for pure research by members of a research staff are being applied more widely today. A recent example of an interesting incentive for members of the regular research staff was instituted by the Monsanto Chemical Co. Each year, four members of the research staff having performed outstanding service will be granted an academic leave at full salary for a full year of study at the universities of their own choice.

How to Set Up A Patent Incentive System

While the establishment of patent incentive systems depends upon the size and nature of the business, and whether or not you have a research staff, these are some of the basic factors:

1 A special committee should be set up to handle invention ideas submitted by employees. Besides management members, the committee should have some members of the research staff on it, as they are especially qualified to judge the merits of the ideas. This should be separate from the regular suggestion committee, to conserve the time of the research personnel on the invention committee.

2 Clerical routine should be set up to handle idea submissions. Each employee should be assured of protection for his idea, and given a signed, dated receipt for his suggestion, or a duplicate of it. Ideas should be handled as promptly as possible, and the employee notified of the merit or lack of interest in the idea.

3 If the idea is patentable, the company must arrange to handle the legal work and attendant expense in connection with securing the patent. Usually, the employee is paid some nominal sum at the time he signs the application for the invention.

4 When the patent is secured, the payment of a further sum is the usual practice, depending upon the extent of the incentive expected to be achieved. Some companies also make special awards for outstanding patents, while others also make royalty arrangements giving the employee a stated percentage of royalties received from the company's use or the outside sale and license of his patent. A further incentive to this royalty plan is the addition of special personnel to promote outside sale and license of such patents.

5 In royalty arrangements, it is frequently advisable to provide for higher reward for a brand-new product, than for inventions involving major improvements on a present product, and even less for minor improvements.

6 Where the immediate reward set for the patentable invention is rather low, a further incentive can be applied by establishing an annual prize for the most outstanding invention, with a few minor prizes. Cash award plans frequently have this feature.

7 While many large companies have a special patent department, staffed with several patent attorneys, the legal department of smaller companies can handle this chore through an outside registered patent attorney.

8 There is growing feeling that research personnel should also be included in patent incentive arrangements, even though they are expressly hired for development work. The argument is that special incentives will encourage them to seek new inventions outside of their regular development duties.

9 Progressive companies frequently make provisions to review the value of the invention at later dates, as many new products require several years of development and marketing research before their true worth is indicated.

offers research employees a share of outside royalties, whereas most companies take full rights for patents developed by their research workers. Other companies provide special awards for outstanding inventions.

Some companies feel (and with good reason), that if they are to pay employees for patentable ideas, then they should be rewarded on the same basis as other employees who come forward with valuable sales or marketing ideas, or plans for improving plant efficiency. This attitude accounts for some of the incentive suggestion and award systems set up in some companies, where each idea is paid for on the basis of its indicated merits. The Lincoln Electric Co. provides for extra year-end bonuses for such employees, depending upon the estimated value of the idea, patentable or not, to the company. One company which instituted a liberal patent incentive system received 12 invention ideas from employees withing 60 days, and three were worth filing patents for.

Offer Encouragement

Such plans offer greater encouragement to employees than the simple practice of paying the employee $1, or some other nominal sum for his patent idea, and perhaps rewarding him with a better job. On the other hand, many patent experts feel that research engineers and scientists regularly employed in such capacities by a company are not entitled to special royalty payments for patentable ideas developed in the course of their work. It is held that these workers are being paid to perform such research, and their jobs depend upon it.

Some management engineers insist that the extension of an invention incentive plan to research employees, as well, not only helps to hold good personnel but will attract new, ambitious research workers. Yet, most firms force research employees to sign over patent rights at the time of employment.

It is rather ironic that many metalworking companies aggressively search outside sources for new products, when some of their employees may have patentable ideas but hesitate to come forward with them for no reward. Unless plants adopt invention incentive plans, they may force employees to take their ideas elsewhere, or patent them themselves, which may lay groundwork for damaging new competition over the long run. But, companies must guard against paying too much, if they are to stay in business.

MILLIONS OF DOLLARS

The Patent Hoarding Charge

The question of litigation has been used by some government officials as one reason for their support of legislation to force compulsory licensing of all patents. The other, and major, contention made to justify compulsory licensing is the charge that large companies are hoarding patents and keeping patented products off the market to maintain their older products in production. This charge has never been proven true to any broad extent.

In 1939, the National Industrial Conference Board attempted to learn whether there were any suppressed inventions. Despite contacts with hundreds of engineers, inventors, and others likely to be able to cite such cases, no instance of suppressed useful invention could be found. In 1940, the American Chemical Society along with several other technical groups set up an investigating unit to see if a specific example of the suppression of a useful invention could be found. Only five cases were reported to the group, but the committee found that in no instance was there any wilful suppression. Reasons for prevention of the use of the patent were either lack of capital, competition from a superior invention, or some plain impracticability.

At various congressional hearings, three Commissioners of Patents have testified that they did not know of a single instance of the wilful suppression of a patent.

In actual practice, a manufacturer might have good cause to hold a patented invention off the market for a period of time. This may be due to the necessity of having to change his tooling and buy new equipment, the necessity for market research on the new product, changes in advertising and promotion programs, and the need to convince customers to convert their orders to the new products.

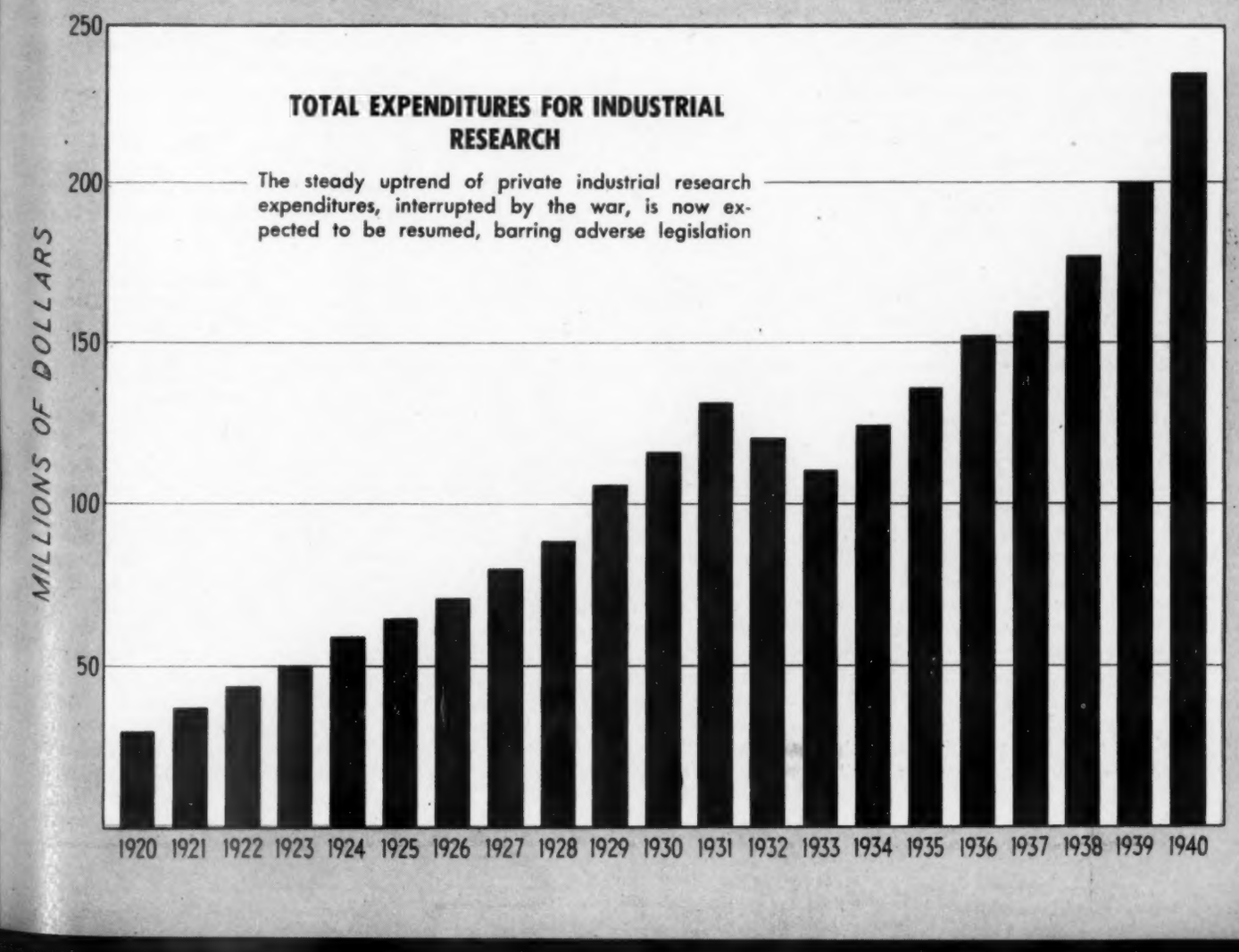
Then again, a company having patented an invention may promptly find a new improvement in the product and immediately patent the later development. In such a case, the improved product would be offered for sale and the initial invention might never be used commercially. In other cases, a manufacturer with a new patent may find that a competitor has started to produce better items on their own patent, which leaves the first manufacturer the option of going ahead with his production in the face of poor competitive prospects or not using his patent until it has been improved over the product of his competitor.

In all of these cases, patents have been held off the market, but without any ulterior motive. As less than one out of every 20 patents is ever used commercially, and most patents are held by small inventors, it would be ridiculous to assume that wilful suppression keeps many inventions from actual use.

Cross-Licensing

Cross-licensing, which is the exchange of patent rights between two or more patent holders, has long been under attack as a monopolistic device and an abuse of the patent system. The required commercial secrecy attending such arrangements only serves to intensify such attacks.

In actual practice, cross licensing is the only way that many patents


TOTAL EXPENDITURES FOR INDUSTRIAL RESEARCH
The steady uptrend of private industrial research expenditures, interrupted by the war, is now expected to be resumed, barring adverse legislation
MILLIONS OF DOLLARS
250
200
150
100
50
1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940

could be used commercially. The reason is that very often the holder of one patent would not be able to make the best possible product without infringing upon patents held by others, and vice versa. The only solution is for them to cross-license their patents to each other. Of course, a company must limit its cross-licensing, unless it is to liquidate entirely its patent advantage over all competitors. But when a patent holder draws the line at some point and refuses to grant some other manufacturer or patent holder a license, then charges of monopoly and restraint of trade are apt to be raised. Such situations also form the basis for some pressure for compulsory licensing of all patents.

A responsible government official recently stated that the pooling of patents in many cases was necessary, citing the fact that practically no significant developments in radar could be made unless U. S. and British patents are pooled.

During the war, a great issue was made of the existing international patent agreements between various American firms and industries in enemy countries. Actually, such international exchange of patents is perfectly legal in peacetime, and through such arrangements, the U. S. secured information for producing 100-octane gas, paratone, synthetic toluol and synthetic ammonia, and Buna and Butyl rubber processes. Up to the present, international arrangements on patents were kept secret for commercial reasons, just as were domestic agreements. However, this has been held to encourage the formation of cartels and monopolies.

Compulsory Licensing Threat

The greatest threat to the American Patent System has been the proposal that patent holders be compelled to license their patents to any and all applicants. Industry feels that compulsory licensing legislation (H.R.-3462) would destroy the patent system and kill the incentive for new inventions. The most apparent reason is the relatively poor market value that a patent open to all comers would hold. What manufacturer would buy patents rights for a new product, purchase new equipment, spend money on sales promotion, when he does not know how many competitors he will have in the same business making the same product? Such a state of affairs would leave small companies at the mercy of large companies with bigger plants, more money, and national selling organizations. Yet, the sponsors of compulsory licensing argue that it would help small business by opening up to them the patents held by big business.

Then again, what incentive would large companies have to maintain their research staffs, if every new invention will be automatically available to all their competitors?

Ooms Opposed

Commissioner Ooms is opposed to compulsory licensing, as "it would eliminate the value of the patent as a competitive weapon for small business, would destroy the value of the patent as a compulsion for diversification, would discourage experimentation, and would make inventors the employees of their competitors." However, he thinks that where a patent bars an entire field of technology, that some form of compulsory licensing might be advisable.

But industry spokesmen, such as the National Association of Manufacturers and the National Patent Council, oppose any law which smacks of the beginning of compulsory licensing. Industry fears that compulsory licensing might well be used arbitrarily to throw open various inventions, other than those alleged to be suppressed.

Certain foreign countries, notably England, have compulsory licensing systems for patents. However, the general condition of their industries and the extent of their invention, as compared with the United States, give no evidence of the superiority of their patent system over ours. In fact, all indications point to the superiority of ours, which has been used as a basic pattern for many systems abroad.

But the supporters of compulsory licensing don't see it this way. During the 1944 political campaign, Secretary Henry Wallace, head of the Department of Commerce, of which the U. S. Patent Office is a branch, said, "The solution (to patent abuses) is simple—all patents should be open to license at a reasonable fee."

Mr. Wallace's stand on compulsory licensing, his control over the U. S. Patent Office, and his setting up of the President's Committee on the Patent System, indicate that continuing pressure will be brought to bear for legislation to accomplish this. The Committee already has sent out questionnaires to patent lawyers, patent bar associations, manufacturers, labor and consumer groups, and government experts, asking them, "By what criteria should compulsory licensing be administered in cases where it is recommended?" Among other questions asked was, "What steps should be taken to prevent partial or total suppression of patented inventions?"

Critics of the Davis questionnaire say that it was sent to many people who know nothing whatsoever about patents.

Besides Mr. William H. Davis, other members of the Committee are Tom C. Clark, Attorney General; Dr. Vannevar Bush, Director of the Office of Scientific Research and Development; and Charles F. Kettering, Chairman of the National Patent Planning Commission. The committee is also studying: (a) What action should be taken to prevent issue of patents that are not for true inventions; (b) What action should be taken to make patent protection more simple and effective; (c) Reexamination of the patent system in the light of its constitutional objective of promoting the progress of science.

Other topics include: how to make patent litigation simpler and faster, defining patent abuses and providing specific remedies, whether patent protection should be broadened or narrowed, whether the work of organized research teams should be patented, and a better definition of "invention" to give patents better standing in court.

The agenda is broad enough for the committee to come forward with suggestions for changing almost any feature of the present patent law.

Major Pending Legislation

Aside from the compulsory licensing law (H.R.3462, the Voorhis Bill), business is opposed to the Fullbright Bill (S1248), which would make the Department of Commerce a center for the exploitation of patents. The bill provides that any inventor can take his patent to the Department of Commerce, where a special unit would determine the market prospects of the invention, provided that the inventor turned over to the Department of Commerce the right to license any and all applications choosing to use the invention commercially.

By opening up such patents to licensing by all comers, the government would (in the opinion of some observers) make the invention worthless, despite its declared intentions of helping to exploit the commercial

possibilities of each patent. Royalties of 4% would be charged, under the bill, payable on a 50-50 basis to the inventor and the government.

With or without this basic defect, critics say the bill would result in the deluging of the Department of Commerce with applicants seeking government aid. After all, about 95% of the 600,000 patents still valid are estimated to have little or no commercial value.

Another criticism of this bill is the opinion that the commercial value of an invention cannot be adjudged until someone has had enough confidence in it to manufacture it and place it on the market. Despite this, the bill would enable the Secretary of Commerce to advance up to $1,500 for the further development of any patentable idea.

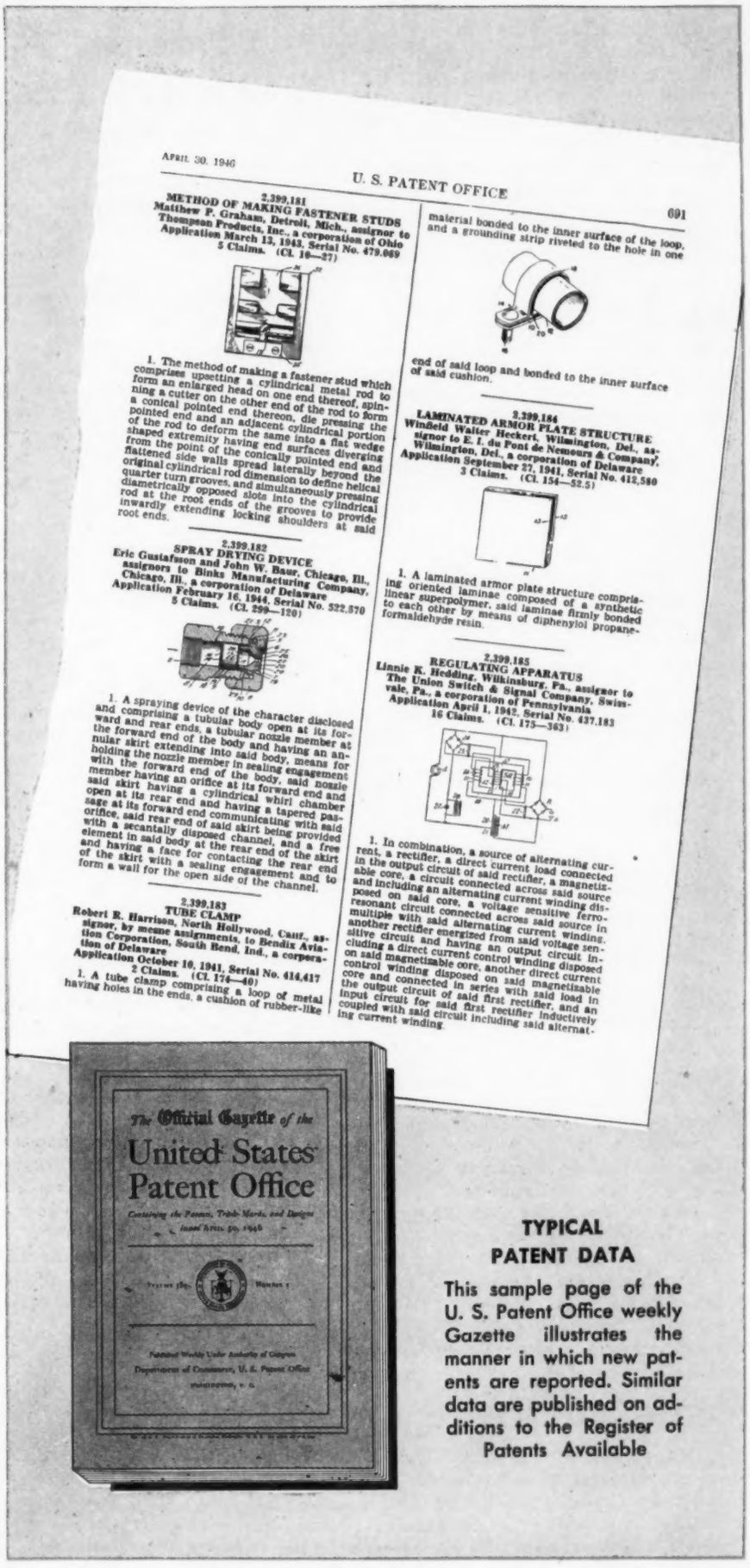
One proposed law (H.R.718) would extend the life of patents for a period of time equal to the wartime interruption in the use of such patents. However, this law has little support in industry or official government circles, because it would provide for favorable treatment of patent holders against war loss, whereas many individuals and businesses suffered war losses for which they are not being compensated.

A law that would help lift some suspicion regarding the misuse of patents by industry is H.R. 3756, providing for the recording of patent agreements (cross-licensing, for example) with the U. S. Patent Office. This would give government agencies access to patent agreements for regulatory purposes, but at the same time maintain their commercial secrecy.

A similar proposal is pending (S.11), which provides for recording in the Department of Justice all agreements pertaining to foreign trade. The industry opposition to this bill contends that it would require recording of all papers relating to international trade, and that the proper place for patent agreement records should be with the U. S. Patent Office, and not with the Department of Justice.

The Science Bills

Industry has heard a good deal about the Kilgore (S.1297) and the Magnuson (S.1285) bills for establishment of a national research foundation. Though both bills have been modified into S.1850, the proposal still carries highly controversial provi-



APRIL 30, 1946 U. S. PATENT OFFICE 691

2,399,181
METHOD OF MAKING FASTENER STUDS
Matthew P. Graham, Detroit, Mich., assignor to Thompson Products, Inc., a corporation of Ohio
Application March 13, 1943, Serial No. 479,069
5 Claims. (Cl. 10—27)

1. The method of making a fastener stud which comprises upsetting a cylindrical metal rod to form an enlarged head on one end thereof, spinning a cutter on the other end of the rod to form a conical pointed end thereon, die pressing the pointed end and an adjacent cylindrical portion of the rod to deform the same into a flat wedge shaped extremity having end surfaces diverging from the point of the conically pointed end and flattened side walls spread laterally beyond the original cylindrical rod dimension to define helical quarter turn grooves, and simultaneously pressing diametrically opposed slots into the cylindrical rod at the root ends of the grooves to provide inwardly extending locking shoulders at said root ends.

2,399,182
SPRAY DRYING DEVICE
Eric Gustafsson and John W. Baur, Chicago, Ill., assignors to Binks Manufacturing Company, Chicago, Ill., a corporation of Delaware
Application February 16, 1944, Serial No. 522,870
5 Claims. (Cl. 299—120)

1. A spraying device of the character disclosed and comprising a tubular body open at its forward and rear ends, a tubular nozzle member at the forward end of the body and having an annular skirt extending into said body, means for holding the nozzle member in sealing engagement with the forward end of the body, said nozzle member having an orifice at its forward end and said skirt having a cylindrical whirl chamber open at its rear end and having a tapered passage at its forward end communicating with said orifice, said rear end of said skirt being provided with a secantially disposed channel, and a free element in said body at the rear end of the skirt and having a face for contacting the rear end of the skirt with a sealing engagement and to form a wall for the open side of the channel.

2,399,183
TUBE CLAMP
Robert R. Harrison, North Hollywood, Calif., assignor, by mesne assignments, to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware
Application October 10, 1941, Serial No. 414,417
2 Claims. (Cl. 174—40)

1. A tube clamp comprising a loop of metal having holes in the ends, a cushion of rubber-like material bonded to the inner surface of the loop, and a grounding strip riveted to the hole in one end of said loop and bonded to the inner surface of said cushion.

2,399,184
LAMINATED ARMOR PLATE STRUCTURE
Winfield Walter Heckert, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware
Application September 27, 1941, Serial No. 412,580
3 Claims. (Cl. 154—52.5)

1. A laminated armor plate structure comprising oriented laminae composed of a synthetic linear superpolymer, said laminae firmly bonded to each other by means of diphenylol propane-formaldehyde resin.

2,399,185
REGULATING APPARATUS
Linnie K. Hedding, Wilkinsburg, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania
Application April 1, 1942, Serial No. 437,183
16 Claims. (Cl. 175—363)

1. In combination, a source of alternating current, a rectifier, a direct current load connected in the output circuit of said rectifier, a magnetizable core, a circuit of said rectifier, a magnetizing and including an alternating current winding disposed on said core, a voltage sensitive ferroresonant circuit connected across said source multiple with said alternating current winding, another rectifier energized from said voltage sensitive circuit and having an output circuit including a direct current control winding disposed on said magnetizable core, another direct current control winding disposed on said magnetizable core and connected in series with said load in the output circuit of said first rectifier, and an input circuit for said first rectifier inductively coupled with said circuit including said alternating current winding.

TYPICAL PATENT DATA

This sample page of the U. S. Patent Office weekly Gazette illustrates the manner in which new patents are reported. Similar data are published on additions to the Register of Patents Available

sions. Businessmen protest that the bill would give domination of a federal research foundation to a politically appointed administrator, with the power to direct research funds to various private and public organizations. Industry would like such a program to depend upon the decisions of qualified scientists and research men to divert research funds into the proper channels.

Some government agencies have also opposed research laws, because they feared that establishment of a central government agency would result in the cutting of appropriations for individual agencies. They also fear that a central board might try to direct the research activities of the various government agencies.

The law would provide for the issuance of patents to the Federal foundation and for non-exclusive licensing of Federally developed patents. This raises the question of whether or not a manufacturer would be interested in starting production of such patented items, when he does not know how many competitors he will have in making the identical product. If this factor hampers commercial exploitation of such patents, then substantial government funds would be wasted in developing inventions which might be impractical of use because of the conditions of their licensing.

If the patent references were removed from the bill and the political inferences of the planned set-up eliminated, then industry would find less objection to the bill. A new bill (S.1777) eliminating the dubious provisions has been introduced in Congress with uncertain chances of passage.

As it is, part of the bill would serve the very constructive purpose of supporting colleges and universities with Federal funds, supporting continued research on military matters and medicine, and further disseminating technical information acquired during or since the war. The need for Federal aid to universities is indicated by the fact that the nation is short of some 150,000 individuals who might have become graduate scientists or engineers if there had been no war, according to Dr. Vannevar Bush.

The Future of Research

Before the war, the government spent about $50,000,000 annually for research (other than agricultural), but wartime needs expanded such expenditures to over $600,000,000. Some government officials fear that if Federal research dropped to its prewar level, industrial progress might be impaired, and that is why Federal legislation for government research is being pushed.

However, industry is expected to spend at least $300,000,000 a year on research in some 2,300 laboratories, employing over 70,000 scientists, and in colleges, universities and other institutions. This would equal the prewar level. But it is doubtful how much industry will spend in competition with Federally-sponsored research and in the event that compulsory licensing is made law.

The contention is made that the government can better afford to conduct long-term costly research into such fields as atomic energy, where such work would be prohibitive for industry and be apt to be long-drawn out. The understandable desire of the government to maintain control over atomic energy has brought up legislation (S.1717) designed to center such power in a special government body. However, in view of the broad uses predicted for atomic energy, industry questions the provision of the bill which would place complete control of industrial use of such power in the hands of the government and would block any private patents in the entire field of atomic energy.

Protecting Your Invention Idea

An inexpensive way to protect your invention idea while showing it to prospective backers is:

1. Make a drawing of your invention on one sheet of paper, and write a description of it on another sheet of the same size.
2. Apply paste to all the edges and stick the two sheets together face-to-face.
3. Sign the back of the pasted sheets before a notary public, and have him notarize the signature.
4. Get a certificate of notary at your County Clerk's office, certifying that your notary is properly licensed.
5. Insert the certificate and the double sheet describing your invention in an envelope, seal it, and write your signature in ink across the flap.
6. Paste a one-cent stamp over the signature and flap, affix the correct amount of postage and send the letter to yourself by registered mail. Have the postal clerk cancel the one-cent stamp at the back of the envelope.

This will eanble you to establish through outside evidence the date you outlined your invention.

SOURCE: *Hudson Motor Car Co.*

Guarding Our Patent System

If industry is to be encouraged in maintaining its postwar production at record levels, then these steps with respect to patents and the patent system should be taken:

1. The staff of the Patent Office must be enlarged and its procedures further simplified to speed up handling of patent applications, so that industry can use the new inventions.
2. Greater care should be exercised in the issuance of new patents to insure greater validity in court.
3. Patent ligitation procedure should be simplified to reduce the time required in handling cases, and the uncertainty as to what constitutes a patentable invention should be cleared up to bring greater uniformity in court decisions on patents.
4. Greater care in patent matters on the part of inventors and manufacturers would help reduce patent litigation.
5. Wider application of patent incentives would help stimulate inventions and invention ideas on the part of plant workers.
6. Legislation for the general compulsory licensing of patents, which would substantially impair the value of patents and the incentive for invention, should be opposed by industry.
7. The Fullbright Bill should be opposed as an expensive project of doubtful value to the patent holders it is supposed to aid.
8. Proposals to prevent the issuance of patents for inventions developed by research teams should be opposed, unless private industrial research is to be stifled.
9. Legislation favoring the recording of patent agreements in the U. S. Patent Office should be supported, to help lift suspicion aimed at secret industrial licensing of patents.
10. Legislation setting up Federal research, particularly in the fields of national defense and medicine, should be supported provided that it does not leave the handling of public funds in charge of a politically appointed official, and does not include patent provisions of doubtful value.

No More German Tool Exports

BY JOHN D. WILSON,
ECONOMICS STAFF
McGRAW-HILL PUBLISHING COMPANY

Once considered the industrial heart of Europe, Germany faces production curbs which open new gateway to U. S. manufacturers

THE OUTPUT and capacity of all heavy industries in Germany are to be limited drastically. A number of industries essential to war are to be eliminated. Among them are certain types of heavy machine tools, all munitions-making equipment and a long list of essential materials.

As a result, Germany will be left with less than half its 1936 capacity for heavy industrial products. Henceforth the Reich is expected to concentrate on consumer goods. But its largest expansion must be in agriculture unless the country is to starve.

One basic assumption underlies the Allied Control Council's agreement: Germany will remain an economic entity. Detailed plans have been formulated for each German industry as an essential step in determining reparations. Tagging of specific equipment for various Allies will be based on that plan.

Machinery production will be held down to one-third the 1938 volume, as the chart indicates. From a position second only to the United States in output of machine tools, Germany will drop precipitately, its operations being limited to 11.4% of the 1938 total. Less than one-third the prewar capacity will remain in metallurgical equipment, mining machinery, turbines, prime movers, boilers and heavy compressors. Facilities for making generators, large transformers and high-tension switch gears will be cut to 30% of the 1938 capacity. Even new machinery for producing consumer goods will be shrunk to one-half the 1938 volume.

Germany, as the industrial heart of Europe, has been the birthplace of a substantial portion of Europe's industrial equipment. Except for Britain, only Germany has had raw materials and skills for equipping other continental nations. Thus Germany's exports of machinery to Europe exceeded the combined total of Britain and the United States. A considerable portion went to Russia. German firms constituted an important source of equipment.

Britain secured substantial quantities of machine tools and other metalworking machinery from Germany. Russia bought more machinery in the Reich during the thirties than in any other foreign market. In the middle Thirties, for example, Germany sold more than one-fourth its total machine tool exports to the Soviet Union.

Even during the war Germany exported machinery. In 1942 shipments outside the Reich were over two-thirds those in 1938. Even in 1944, when under constant air attack, Germany sent its neighbors at work on war materials machinery equal to one-third the prewar exports. In 1942 Germany tried to establish a munitions industry in the Ukraine, an attempt which finally lost a considerable amount of machinery to the Russians.

German machinery production expanded rapidly after 1933. By 1937 it was more than double the 1929 level. Not only was a huge war machine being built, but output for civilian use was expanding. In this respect, German experience was like America's during 1940-1941. By 1938 German industrial production was three-fifths that of the United States and one and one-third that of Britain.

At the war's outbreak Germany had 1,177,600 machine tools, as against 942,000 in the United States. German industry worked almost entirely on one shift, and the number of employees per machine tool was extraordinarily low. In July, 1939, industries using machine tools employed only 2.44 workers per tool (counting all kinds of workers in a plant).

One-shift production continued the accepted practice. Ten percent or less of wage earners in industries making machine tools, small arms and artillery, tanks and motor transport worked on the second shift, and almost none on the third. In the summer of 1944 the number of workers per machine tool was 2.35, slightly less than in prewar days. As against that record, Great Britain showed a ratio of workers per machine tool of 5.7, or just twice the German figure.

TABLE I—ANNUAL OUTPUT OF CAPITAL GOODS EXCLUDING ELECTRICAL EQUIPMENT, 1939-44

(In thousands of metric tons)

PRODUCT	1939	1940	1941	1942	1943	1944
Machine tools	276.7	288.4	314.7	290.0	272.6	218.1
Other machinery	2,199.4	1,922.6	1,979.2	1,881.2	1,500.0	986.6
(1) Boilers and heating equipment	775.9	774.2	893.8	872.0	770.1	521.0
Rolling stock	525.9	605.0	772.4	931.3	1,145.2	906.0
Total	3,777.9	3,590.2	3,960.1	3,974.5	3,687.9	2,631.7

(1) Steam boilers, exchangers, heating and ventilating equipment.

Sources: Statistical data prepared by the Wirtschaftsgruppe Maschinenbau at Saalfeld, Germany, July 1945, for the Equipment Division of the U. S. Strategic Bombing Survey, and statistics of the Wirtschaftsgruppe Stahl- und Eisenbau. Taken from "The Effects of Strategic Bombing on the German War Economy," p. 217.

Germany's capital equipment steadily increased during the war. Not until 1944 did the tonnage of new equipment output fall below that of 1939, and then only one-fourth. There were shifts, of course, in the kinds of equipment produced. Manufacture of rolling stock almost doubled, while many kinds of machinery not vital to war declined. More valve fittings, expendable tools, foundry equipment and stationary engines and power units were turned out in 1944 than in 1938. Throughout the war machine-tool production maintained the high level of 1939.

Why did Germany continue its large output of machinery through the war years? Destruction of equipment by Allied air attack was not the reason, because it was not sufficiently extensive. On the contrary, the relatively easy position of the Reich with respect to capital equipment reflected failure to mobilize completely for war. Germany at first expected a short conflict. The machinery industries were able to meet substantial commitments for the munitions industries even while turning out a considerable volume for peacetime use. The corporate tax structure favored the ploughing back of profits, and peacetime industries sought to prepare themselves for broad postwar expansion.

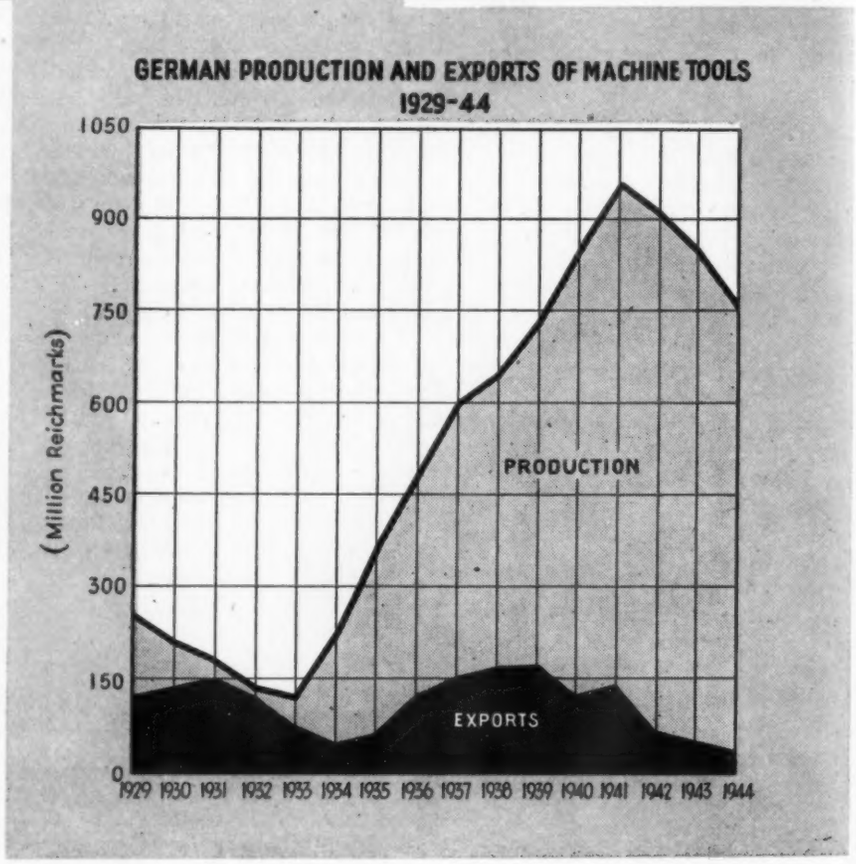
Neither the machinery industries nor their customers favored serious curtailment of output, and raw materials controls did not force it. Not until the last quarter of 1944 was the use of iron for machinery production drastically cut. Meanwhile many industrial leaders, realizing that the war was lost and anticipating inflation, continued to buy equipment in preference to holding cash or bonds.

Two other factors attest to the abundant capacity of the German machinery industries: first, the ability of producers to take on munitions contracts, and secondly, their record in repairing damaged machinery. By 1944 Germany's machinery industries had converted 45% of their capacity to munitions items. Even 30% of machine-tool capacity had been turned to munitions production. The repair job took only a small portion of productive facilities. Until early 1944, for example, only 6% of the total machine-tool building capacity was needed for repair work. From then on the repair program took only slightly more than 10%.

By 1945 Germany possessed more than 1,800,000 machine tools, almost twice as many as in 1939. The Allied Control Council is now taking an inventory of this equipment. As of May, 1938, Germany's machine tools consisted of the types and numbers shown in Table II. At that time two-thirds were over eight years old, 19% were less than three years, and 14% between three and eight years. Production of machine tools from 1938 through 1944 is listed in Table II, the composition of the output each year remaining about the same.

The proportion of special-purpose tools in Germany is much smaller than in the United States. The Reich never employed extensively mass production methods. Moreover, when labor eventually became scarce and single-purpose tools would have been especially helpful, producers were reluctant to invest in them. They were thinking then of peacetime needs. As a result, output of special-purpose tools never exceeded 8% of the total in any year.

Maximum number of machine tools destroyed in 1944, the year of the heaviest bombing raids, was 36,000. Not more than 110,000 were damaged and repaired. In other words, not over 6½% of all machine tools in 1944 were damaged or destroyed by air raids. Reports from industries suffering heavy precision air attacks



bear out these conclusions. Only 16% of the machine tools in the ball-bearing industry were damaged or destroyed from the beginning of the war until October, 1944. Only once did single raids damage or destroy more than 5% of the machines in the target plants.

Of 73,000 machine tools in the airplane engine industry, only 2833 were destroyed or damaged in 17 precision raids up to the autumn of 1944, a ratio of less than 3.9%. This figure omits machine toools only slightly damaged and repaired in the plant itself. If these machines were added, the ratio would be about 8%.

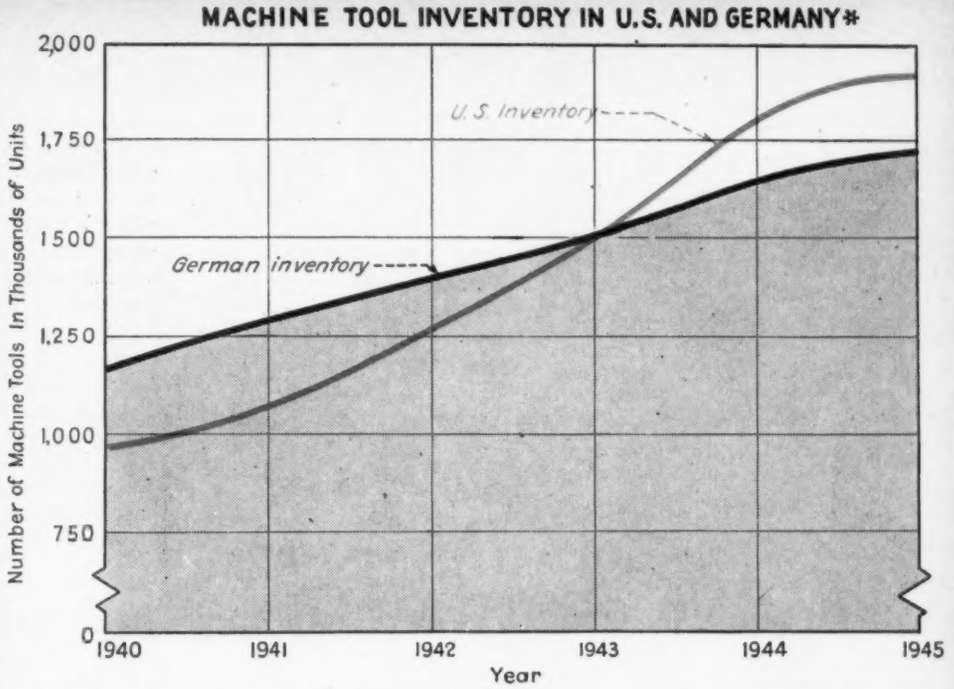
German machine-tool production hereafter will be limited to 18,000 tools annually. Certain restrictions will be applied regarding the quantity of various tools as well as their sizes. With such severe curtailment, Germany is not likely to resume machine-tool exports. Contrast this situation with that before the war when more than half of Germany's machine-tool production was for export and three-fourths of the machine tools purchased by European countries, including Britain, came from Germany. The net effect of this reversal of operations is to throw open to machine-tool builders in other countries markets which for all practical purposes were formerly closed to them or were greatly restricted.

The size of the European machine-tool market will depend on what happens to Germany's surplus tools. Russia will get a large number (she already has appropriated a generous volume). France and other countries will secure a sizable quantity. If these nations are willing to use second-hand machine tools from Germany, a large chunk of the new machine-tool demand will be sliced off. The fact is that the number of machine tools needed on the Continent, excluding Russia, probably will be less than in the latter Thirties. This is an inescapable conclusion stemming from two factors: first, war production requires an exceptionally large volume of machine tools, and secondly, expansion of industry in the rest of Europe will not offset the decline in Germany.

The inventory of 2,000,000 machine tools in Germany in 1945 includes Austria and the German areas now incorporated in Poland. The exact number in the Germany of today can be determined only by the Control Council's inventory. Certain facts, however, are known. About 61% of all manufacturing and mining output in the Reich came from the western zones in the prewar period (Austria excluded). The Berlin district contributed a further 8%. The Russian zone and the area east of the Oder which is now Polish produced the remaining 31%.

Though these proportions were altered during the war, the change was not great. The Germans expanded facilities in those areas which already contained machine tools, just as the United States did. The western zones had an overwhelming proportion of capacity for iron and steel production and for making iron and steel products. The eastern zone was relatively strong in consumer goods.

Thirty percent of the machinery producing capacity was in the Soviet zone. An unusually large proportion of machine-tool production was in this area, particularly in the Magdeburg-Leipzig and Chemnitz regions. Poland has inherited from Germany few machinery producing facilities. The same is true of Austria, which



* *In order to compare with U.S. figures, the German inventory was adjusted to exclude such metal-forming machines as presses, forging, hammers, extruding machines and shears*

TABLE II—GERMANY'S METALWORKING MACHINES, 1938-1944

TYPE OF TOOL	(Number of Units) TOOLS IN USE MAY 1938	DELIVERIES 1938-1944	1938 Inventory plus Deliveries 1938-1944	% Under 10 yrs. Old	% 10 yrs. & Over
Planers and Slotters	60,803	35,277	96,080	45.5	54.5
Engine lathes	243,825	207,194	451,019	56.0	44.0
Turret lathes & Automatics	86,581	73,212	159,793	56.4	43.6
Drill presses & Horizontal boring machines	258,657	221,343	480,000	59.0	41.0
Milling machines	122,374	92,264	214,638	53.4	46.6
Saws	44,683	42,956	87,639	61.2	38.8
Grinding & Polishing Machines	169,166	187,353	356,519	64.0	36.0
Gear Cutting machines	16,439	16,015	32,454	60.5	39.5
Total Machine Tools	1,002,528	875,614	1,878,142		
Hammers, Forging & Riveting machines	33,081	28,416	61,497	54.9	45.1
Sheet metal machines, presses	243,192	245,959	489,151	56.9	43.1
Wire coiling & working machines	47,393	43,772	91,165	52.8	47.2
Special-purpose machinery	(1)	2,329(1)	2,329	100.0	100.0
Total	1,326,194	1,196,090	2,522,284	57.4	42.6

(1) Not all special-purpose tools are included. No attempt was made in the 1938 inventory to separate such tools.

NOTE—No allowance has been made for possible scrapping of tools during the 1938-1944 period.

Source: Prepared by Wirtschaftsgruppe Machinenbau for Equipment Division of Strategic Bomb Survey.

was largely dependent upon Germany for repair of equipment, particularly replacement of parts. Austria today has much damaged machinery which it is unable to rehabilitate.

The Potsdam agreement provided that the U.S.S.R. is to receive 25% of the capital equipment in the western zones not necessary for Germany's peacetime production. The machine manufacturing industries were singled out, along with metallurgical and chemical facilities, as the first source of Soviet reparations. The Soviet is known to have removed as war booty certain equipment from areas it first controlled. Apparently the decision is to exclude this equipment from the total upon which reparations are to be based, and a larger proportion of the facilities in the western zones will be needed to provide the minimum capacity that Germany is to be permitted to keep. Thus the equipment available as reparations, both to the western Allies and to Russia, will be less than anticipated.

Germany's deindustrialization means the transfer to Russia of immense stocks of machinery of all types, including machine tools, thus speeding the Soviet's industrialization. The process is likely, however, to leave all save eastern Europe poorer than it otherwise would have been. For Germany formerly supplied other European areas with machinery and other goods, accepting in return a wide variety of products.

Russia probably will remain in large part a closed economy. Reduced living standards in Germany may spread to other European countries, for these areas will find it hard to develop the same type of trade relationship with Britain and the United States which they once had with the Reich. Over the long pull, U. S. machinery manufacturers may find the Control Council plan for Germany a mixed blessing.

Why the German Machine-tool Industry Should Be Suppressed

Dear Editor:

At this time, when we have on hand the prewar data about the U. S. machine-tool industry, its war record and some idea of what will be expected of it in the future, we should determine what the industry's future policy should be.

We owe this much to the companies, the future success of which will depend upon action taken now, and to the country, which must have on hand the best machine-tool industry.

It may be well to say again that whatever tomorrow's weapons will be made of, the machine-tool industry will be called upon once more to transform into items available to the Army and Navy the ideas of Army and Navy technicians. The demand then will not and cannot wait. Much will depend upon the facility of the industry to absorb the demand in the specified time, which necessarily will be short.

The reason that more recognition is not given the machine-tool industry is simple: The dollar value of its production is small compared with other important industries. Yearly sales of automobiles, for instance, averaged $2,085,000,000 from 1937 to 1939 inclusive, of chemicals $3,726,000,000, of steel $7,018,000,000, but machine-tool volume was only $180,000,000. The machine-tool industry's manpower requirements during that period were about 44,000 men. But in 1942 and 1943 machine-tool production rose to $1,320,000,000 and $1,100,000,000 respectively. The number of employees had expanded to more than 100,000 in 1944. These last figures show clearly the importance of the industry's war assignment.

As it stands today, the U. S. machine-tool industry possesses plants which are considerably enlarged compared with prewar and, what is worse, with a large amount of machines produced during the war being thrown on the market to take the place of new tool sales. Actual demand for new machines comes to a great extent from foreign markets. This export demand will keep up for some time. If proper steps are taken, a permanent foreign market can be established.

This broader base for the vital machine-tool industry can be achieved by a simple measure derived from the victory over Germany. During the prewar period, Germany had built an industry bigger than the U. S. industry. France's importation of machine tools, for example, came from these sources at that time: Germany 52%, United States 40%, Britain and others 8%. The machines bought from Germany were not sold alone on price. Advanced design and a product suited for European needs were powerful factors. France was not alone in this situation. German imports were gaining ground at the expense of American machine tools in other countries too.

Today the German machine-tool industry is stopped. The Russians, we hear, have transferred some plants completely, men and machines, to their country. The British have taken a similar step, at least in one instance. In that case, a German plant, making a machine very competitive to an American machine, has been transferred to England.

Immediately after the entry of America into the war, we know that Germany began to produce American machines that could no longer be imported, copying them to the last detail so closely that, looking at them, no difference could be seen between the German-built and the American. This shows how the German machine-tool industry was keyed up and how carefully its plans were laid to insure a proper supply of machines at all times.

When one considers the part played by the German machine-tool industry in Germany and in foreign markets, the role it can enact tomorrow if we let it rise, the vital need for a consolidation and strengthening of American machine-tool export markets, there is only one answer—suppression of the German machine-tool industry.

The decision should be made now. The small manpower involved in the industry will not solve Germany's employment problem. It is not an essential industry for Germany, but it is essential for other nations, particularly the United States, that it should disappear.

Lucien F. Rose,
Chief, Machine Tool Division, French Supply Council, Washington, D. C.

Congress has acted—and along these lines—since this editorial was written. If the President signs the legislation, we have taken one step forward. If he vetoes it, the voters must resolve a conflict between two branches of their Government.

THE LABOR CRISIS
—*it's up to Congress*

IT HAS remained for John L. Lewis to demonstrate conclusively that, under the sponsorship of the federal government, the power of organized labor has been built up to a point where it can be used to paralyze the economic life of the nation. Therefore, in the elemental interest of self-preservation, the first order of the day is to cut down the power of organized labor to a point where irresponsible leaders no longer have the power to use it to cut down the country.

This will prove an exceedingly complicated job. The federal government, over a dozen years, has developed and buttressed the power of organized labor by many separate steps. They are interlaced in a pattern which cannot easily be unravelled.

Cutting down the power of organized labor to proper proportions will be an operation almost as delicate as brain surgery. To be successful it must impair no basic American political or economic right. It must leave intact the right of workers to organize and bargain collectively through representatives of their own choosing. It must leave intact the right to strike. But it must disassociate from the exercise of these rights opportunities for devastating abuse of the public welfare such as those demonstrated by Mr. Lewis. A meat axe is not the instrument for this operation.

Because of the complexity and delicacy of the operation to be performed it would be helpful if it could be carried out in a tranquil atmosphere. The urgency of the problem is such, however, that no time can be lost in getting at it.

Guiding Principles

However, the dangers that haste or heat will lead to serious blunders can be largely eliminated if the process of bringing the power of organized labor back within safe and reasonable bounds is governed by principles to which all fair minded people can fully subscribe.

The most important of these principles is that it is an abuse of public authority to extend special privileges to organized labor.

When in 1935 Congress passed the Wagner Labor Relations Act, one of the great buttresses of the power of organized labor, it was upon the explicit theory that organized labor was weak and needed coddling by the federal government if it were to survive, let alone grow big and strong. In the policy section of that act it was stated that "the inequality of bargaining power between employees who do not possess full freedom of association or actual liberty of contract, and employers who are organized in the corporate or other forms of ownership association substantially burdens and affects the flow of commerce . . ."

Regardless of whether or not that was a correct reflection of the situation in 1935, it bears no relation to the situation today. Under the continuous sponsorship of the federal government, the power and bulk of organized labor has waxed until today it is preposterous to regard it as the weak sister in its bargaining with employers. If, after being continuously demonstrated since V-J Day, the proposition that the pendulum of organized power has swung too far over on the side of organized labor needed any final and clinching demonstration, John L. Lewis provided it.

Changes in the Law

Translation of the principle that organized labor is no longer a weakling, requiring a diet of special privileges, into specific legislative enactments is a detailed technical operation beyond the scope of this statement. It is possible, however, to indicate some of the general lines it should follow. Here they are:

1. The duty to bargain collectively, now imposed upon employers by the Wagner Act, should also be imposed upon the leaders of organized labor who are now under no legal compulsion to bargain.

   For well over a month Mr. Lewis made a complete mockery of the process of collective bargaining by refusing even to state his demands until the coal operators had approved "in principle" a plan for a miners' "health and welfare" fund which he fancied. In the meantime the country was plunged into an ever deepening crisis.

2. Unions, as well as employers, should be made liable to suit for damages for breaking their collective bargaining agreements.

   A degree of responsibility commensurate with their age and power requires that unions be liable, to the extent of union funds but not the funds of individual members, for carrying out their agreements. To have it otherwise is to hold that a collective bargaining agreement is, by defi-

nition, a phoney agreement so far as the union is concerned. Outlaw strikes are the fruit of this lop-sided arrangement.

3. Employers should be given more discretion, in reinstating employees who have gone on strike than is now permitted by the Wagner Act.

The Wagner Act largely eliminates the risks involved in striking because of the requirements it imposes upon employers to take workers back when they have decided to return to work. These requirements make it virtually impossible for the employer to replace workers even if they are engaged in the most unjustifiable of strikes. At the least workers who have smashed up property and stirred up violence in the course of a strike should have no rights under the Wagner Act. How much further the Wagner Act straitjacket should be loosened at this point should be carefully explored, and excesses encouraged by the Act should be removed.

4. The wedge which the National Labor Relations Board has driven into the orderly conduct of American industry by holding that foremen are covered by the Wagner Act should be eliminated.

The issue involved here is continuously mislabelled and confused as that of the right of foremen to organize. There is no question of the right of foremen to organize any kind of a legal organization they desire. That is their right as American citizens. The issue is whether or not the special privileges accorded by the Wagner Act, which in some circumstances has been so construed as even to prevent employers from talking with their workers, should be extended to foremen who, if American industry is to have a chance to do its duty effectively, must represent management with full loyalty and responsibility.

A member of John L. Lewis' United Mine Workers takes an oath which provides, in part, "that I will not reveal to any employer or boss the name of anyone a member of our union" and will "defend on all occasions and to the extent of my ability the members of our organization." Mr. Lewis insists that the coal operators contract to deal with foremen to be organized in a union where they will take that oath, and where their activities will be separated from the influence of employers by the barriers imposed by the Wagner Act. Such an arrangement undercuts orderly management of American industry.

5. The exemption of labor unions from the federal anti-trust laws, provided when organized labor was presumed to be weak, should be modified to take account of its vastly increased strength, and the use of this strength to destroy business enterprise and create monopoly.

As matters stand unions can run employers completely out of business by secondary boycotts and run fellow workers out of jobs in the process. An Ohio manufacturer, working with a government-certified C. I. O. union, is put out of business because A. F. of L. workers refuse to handle his products. Still the government, this time in the person of the United States Supreme Court, says that actions of this sort are above the law because Congress exempted unions from the federal anti-trust laws.

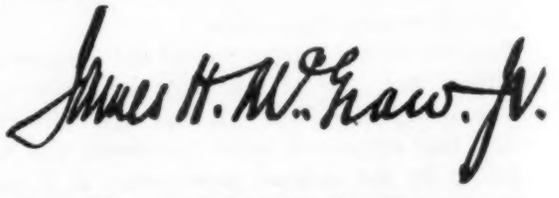
To eliminate one of the most devastating forms of restraint of trade, this exemption should be cut down forthwith by subjecting unions imposing secondary boycotts to the same penalties under the federal anti-trust laws as those to which employers doing the same thing are subjected. And the question of further narrowing the obsolete exemption of unions from the federal anti-trust laws should be fully explored.

6. The levying of special sales taxes for the exclusive benefit of unions should be prohibited by law.

As a matter of good government the right to levy consumption taxes should be reserved to the public authorities and used strictly for public purposes. As a matter of good economics, payments to workers or their organizations should be included in the payroll where they can be properly counted as part of the cost of production.

Equality Before the Law

When everything that can conceivably be accomplished by legislation has been accomplished there is no reason to believe that an ideal or even a surely workable system of industrial relations will have been devised. Many of the mainsprings of such a system lie deep in the hearts of men and far beyond the reach of legislation. There is no chance, however, of having such a system, or even a defensible system of democratic government until special privileges which tip the scales of power far on the side of organized labor are withdrawn and there is some measure of equality for employers and organized labor before the law. Though it is hard to believe it at the moment the country may come to be grateful to John L. Lewis for driving that lesson home so ruthlessly.



President, McGraw-Hill Publishing Company, Inc.

How to Sharpen Tangent Chasers

BY H. SCHLARMAN

In this installment the author tells of the principles of tangent chasers, with and without helix, and their practical application

UNLIKE THE RADIAL CHASER the tangent offers no complications of either chaser teeth or chamfer clearance angles. These are taken care of by the design of the head, the chaser holder and by the very nature of the tangent chaser which is always tangent to the stock.

The problem of bearings is also simplified. Whereas the bearings of the guiding teeth and cutting chamfer are dependent on one another in radial chasers, they are independent of each other in the tangents.

The same principle that controls the action of any type of chaser controls that of the tangent. That is the principle that the bearing of the chamfer, including the first full tooth, should be such as to allow an efficient cutting action; and the bearing of those teeth beyond the first full tooth should be so heavy (above center) as to prevent them from cutting and force them to act as lead guide teeth.

These bearings can be easily ground independently of each other by the user, since there are no complications of clearance angles. The chamfer is ground the full length of the chaser by the chaser manufacturer. This takes another burden off the user.

The chamfer angle, on chasers with and without helix, is ground parallel with the leading edge of the chaser, so that a constant width of chamfer is maintained from the first to the last grind. The angle of the chamfer can be reduced to give a longer cutting edge; but it is always troublesome, and sometimes impossible, to increase the angle of chamfer to produce a shorter cutting edge.

Another factor that makes the tangent easier to handle is that the top rake is equal to the visible or actual hook. If the chaser is ground with a 15° hook, the actual top rake is 15°.

In the grinding of any type of chaser, always use the grinding fixtures, measuring and setting gages, as well as the methods recommended by the manufacturer of the die equipment.

The following are definitions of some terms that will be used.

End Grind, Fig. 41: The first operation, in resharpening any tangent chaser; to remove the worn portion, and produce the bearing for the full (guiding) lead control teeth.

Rake Grind: The second operation producing the cutting edge to the proper top rake and bearing.

Parallel Rake Grind: So called because the rake grind must be done in such a manner as to produce a cutting edge on which every point is the same distance above center, or in other words, the cutting edge is parallel to the cutting center plane. Fig.

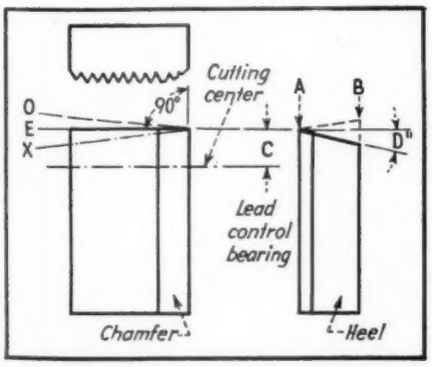


Fig. 41—Diagram for the end grind

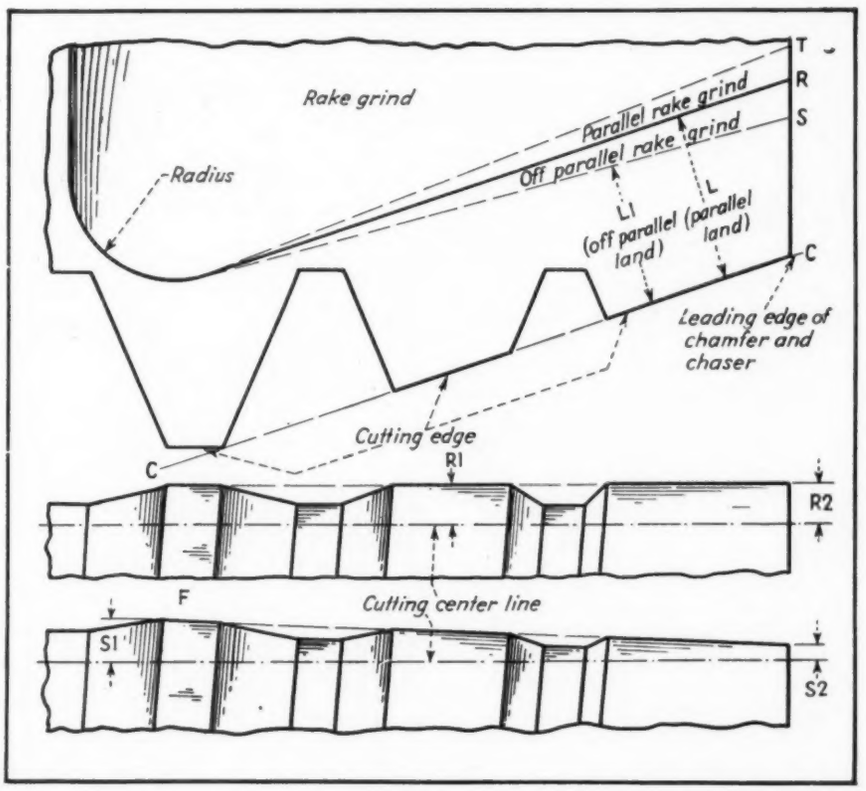


Fig. 42—Parallel rake and off-parallel grinds for tangents with helix. View 2 shows the condition of parallel bearing R2 on the cutting edge for tangents with or without helix; view 3 shows the off-parallel bearing from S2 to S1 resulting from an off-parallel grind

42, line *R* shows a condition of parallel land *L* which will make the whole cutting edge sharp at the same time and produce a parallel bearing, view 2, on tangents with helix. Grinding the rake on tangents without helix to the helix of the thread or holder as shown by angle *C*, Fig. 47, will produce the same parallel cutting edge bearing, view 2, when the chaser is set in the chaser holder as shown by *C*, Fig. 46.

Off-parallel Rake Grind: This produces a cutting edge having the lightest bearing at the leading edge of the chamfer. The bearing gradually increases to its heaviest point at the first full tooth. Line *S*, Fig. 42, shows the condition of off-parallel land on tangents with helix which will produce an off-parallel cutting edge bearing as shown by view 3. If angle *C*, Fig. 47, is made less than the helix of the thread or holder on tangents without helix an off-parallel bearing will result.

The line *S* indicates the correct condition of land narrowing off-parallel and will be designated as "right off-parallel rake grind;" Line *T* indicates the incorrect condition and will be called "wrong off-parallel rake grind."

Full-rake Grind, Fig. 43*B*: This is a top rake grind across the full width of the chaser.

Fig. 43*A* shows the general appearance of a tangent chaser as normally ground with end and rake grind for cutting straight threads.

Sharpening the Tangent Chaser With Helix

This requires a grinding fixture so designed that the chaser fixture can be swiveled for the top rake as well as tipped to make the rake produce a land parallel to the chamfer edge.

Tangent chasers with helix must be sharpened locating from the heel or the surface used to locate the chaser relative to the cutting center. A gaging means must be provided that will measure the bearing relative to these same points.

If a grinding fixture and measuring gage of proper design is provided, the tangent with helix can be easily controlled since the rake angle and distance above center can be measured and recorded for repeated efficiency of cutting edge and accuracy; if not provided, the chasers will be troublesome on factors of cutting action and accuracy unless some means, as a stop gap, such as the micrometer method Fig. 47, is used for checking lengths and bearings.

Because the helix spacing is machined into the chaser relative to the heel and the lengthwise holding surface, it is imperative that all chasers in a set be ground to the *same length* within a few thousandths of an inch. If this is not done, a poor thread will result from a varied bearing of cutting edge and off-spacing of the chaser.

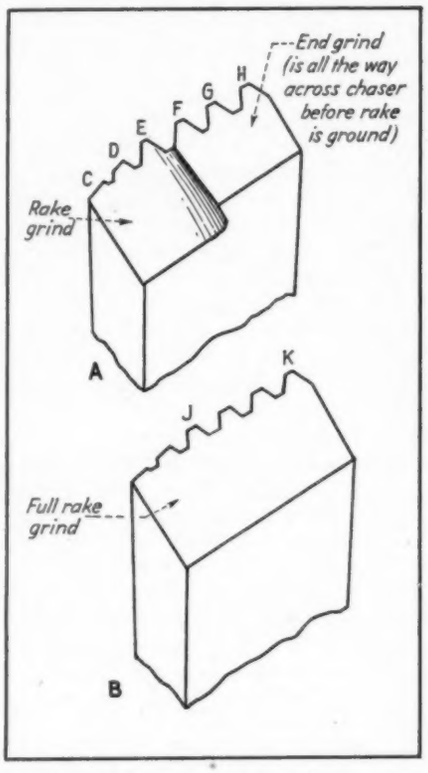


Fig. 43—The appearance of the tangent chaser: *A*, Sharpened with the end and parallel rake grinds; *B*, sharpened with the full rake grind

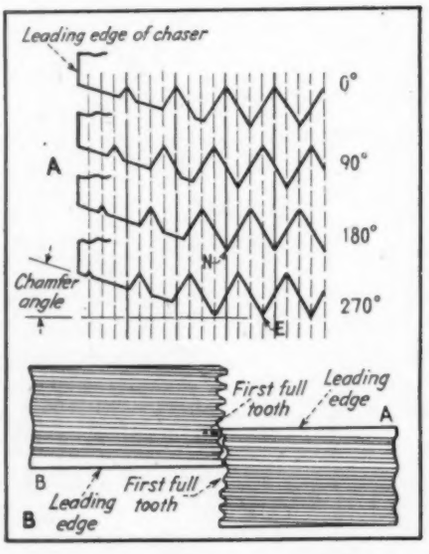


Fig. 44—*A*, Condition of spacing in all chasers. *B*, Visually locating the first full tooth either farthest from or nearest to the leading edge of the chaser

The first step in sharpening is the end grind Fig. 41. *E* should be as close to 90° as can easily be measured with the common protractor. Any variation of *E* should be in the direction of *O* and not of *X*. If the bearing *C*, at the chamfer end, was on the light side, an end grind along *X*, might bring the back teeth too close to center and allow them to cut. The purpose of the end grind on tangents, with or without helix, is to leave the chaser edge so far above center that it cannot possibly cut. This bearing *C*, which produces the guiding lead control action of the chaser is not critical as long as it is heavy enough so that the teeth cannot cut—the following values for *C* will be found sufficient for general use.

Thread Diameter	*C*
0-3/16 in.	0.012-0.015 in.
¼-⅝ in.	0.020-0.025 in.
¾-1¼ in.	0.025-0.030 in.
1⅜-2 in.	0.030-0.035 in.

Angle *D*, Fig. 41, should be 3-5°. This assures a gage reading at the chaser edge *A* and not at some point such as *B*.

Grinding the Rake

The second and last step in sharpening the chaser is producing the cutting edge to the right bearing by grinding the rake.

It is general practice to use the parallel rake grind on chasers cutting straight threads because it is easier to check for cutting bearing, easier to set relative to cutting center, and produces a satisfactory finish for the average thread job.

Before grinding the rake it is advisable, for minimum setup, to pick out the chaser in the set having the first full tooth farthest from the leading edge of the chaser. Fig. 44*A* shows *E*, the tooth farthest from, and *N* nearest to, the leading edge of the chaser as caused by the spacing of the chasers in a set. It should not be inferred that the nearest or farthest first full-tooth chaser is the same numbered chaser in every set. As a matter of fact it will change from one chaser to another as the chasers with helix are resharpened because of the helix.

Fig. 44*B* shows a simple way to find either the nearest or farthest first full tooth chaser. By laying the cutting edges of the chasers of a set end-to-end, either the farthest or nearest first full tooth chaser can be easily found. The leading edge of *A* is placed at the first full tooth of *B*. It can be seen that *A*'s first full tooth

is farther from the leading edge than *B*'s.

The chaser with the farthest first full tooth is used in setting up on the grinder. If the grinder is set to clean up this first full tooth, the other first full teeth will be cleaned up since they are nearer the leading edge of the chaser.

The first full tooth nearest the leading edge can be found in the same way. The nearest first full tooth is seldom used as the standard by which to resharpen the chasers. When the job is close-to-shoulder, and the thread is only 2 or 3 pitches long, using the nearest first full tooth to set by sometimes works out better. However, these cases are not too numerous; therefore, unless specifically stated otherwise, any reference to the first full tooth will refer to the one farthest from the leading edge of the chaser.

Fixture Is Tilted

The first full tooth completes the cutting of the full form of the thread. It is, therefore, important to finish and production per grind that each first full tooth on every chaser in the set be sharp. This is true of tangents with and without helix.

Next, the grinding fixture is tipped for the necessary top rake as shown in Fig. 45*A*. The sharp corner of the wheel is radiused with a silicon carbide stone Fig. 45*B*. This radius is not critical. A good radius would be of a size between half to one pitch of the thread.

The chaser is then tilted, as at *B*, until a parallel land is produced as shown by shaded portion *L* of Fig. 45*C*. The wheel is then fed in until the radius comes out between the first and second full tooth as at *X* (Fig. 45*C*). As now set, the first full tooth of all the chasers will clean up and a parallel rake grind will result. The rake is ground deep enough to produce a cutting edge of the required bearing.

The following table will give an idea of rake grind bearings:

Thread Diameter	Bearing (cutting) teeth above center)
3/16-⅝ in.	0.004-0.006 in.
¾-1¼ in.	0.006-0.010 in.
1⅜-2 in.	0.010-0.012 in.

The above are approximate figures for the average steel or non-ferrous metal. The bearings will have to be increased if, because of the material, a chattered or drunken thread is produced; and decreased if they cut hard or run to heavy bearing quickly.

The end and rake grind procedure is used on chasers, for cutting straight threads, required to control their own lead without the aid of a lead screw. Fig. 43*A* shows the cutting teeth *C*, *D*, and *E* produced by the rake grind; and the non-cutting lead control teeth *F*, *G* and *H* resulting from the end grind.

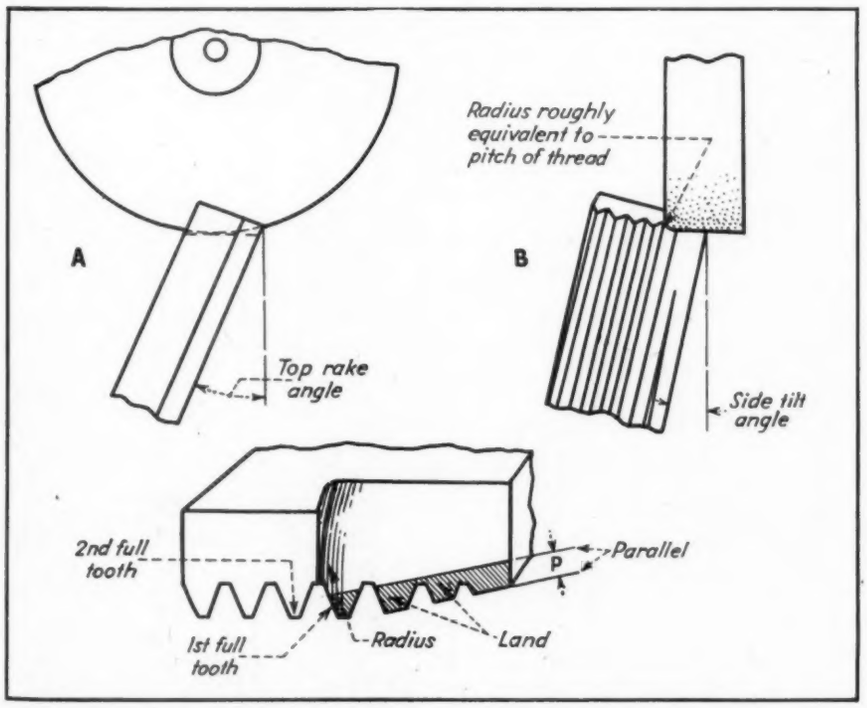


Fig. 45—Points of setup for the parallel rake grind to produce a cutting edge parallel to the cutting center plane

Sharpening the Tangent Chaser Without Helix

The principle governing this is exactly the same as for the tangent with helix. However, the execution of the principle is different in some respect because of the difference in the required design of the holders for tangents without helix.

The basic difference in holders for tangents with and without helix is shown in Fig. 46. The tangent with helix has its own helix (lead); therefore, it is held parallel to the face of the diehead. The holder has no helix. The tangent without helix gets its helix (lead) from the holder; therefore, the chaser is held at the angle of the thread helix to the die face. This factor must be remembered when sharpening tangents without helix.

The end grind, to remove the dull part of the chaser and produce the lead control teeth, is the first step. This can be done in two ways, see Fig. 41; (1) *E* equal to 90°, angle *D*, equal to 3-5°; or (2) *X* equal to the helix of the thread or holder, *D* equal either to 3-5°, or the top rake. The value of angle *D* is immaterial as long as it is positive. The design of the sharpening equipment would determine which end grind could be done fastest.

Pick out the chaser with the first full tooth farthest from the leading chamfer edge and set the grinding equipment to the required top rake. Then tip the chaser to the helix of thread or holder, angle *H*, Fig. 46*B*, and feed in until the rake produces a cutting edge including the first full tooth. The top rake radius should come out at *X* as shown in Fig. 45*C*.

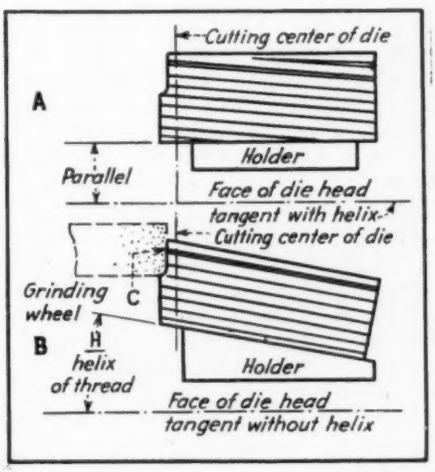


Fig. 46—Difference in the way tangent chasers, with and without helix, are held in the chaser holder

No attention is paid to parallelism of land. The parallelism of bearing (equal distance above center of entire cutting edge) produced by the parallel rake grind on tangents with helix through the parallelism of land; is produced on tangents without helix by tipping the chaser to the thread helix angle. When assembled in the chaser holders, the cutting edge *C*, Fig. 46*B*, is turned parallel to the cutting center of the die because of the helix on the holder.

The rake is ground deep enough so that the edge of the guiding teeth *G*, Fig. 47 is enough above the cutting edge *C*, to make the guiding teeth non-cutting. If some definite means of measuring the chaser bearings is provided, the same bearings can be used on tangents without helix as on tangents with. However if no direct means of measuring the chaser bearings is furnished, dimension *B*, Fig. 47, must be measured by scale or micrometer. Measuring *B* with micrometers will give more grinds per chaser because of greater control. The following values for *B* should be sufficient to keep the guiding teeth from cutting:

Diameters	*For Micrometers*	*For Scale Not Less Than*
to ¼ in.	0.012-0.015 in.	1/64 in.
to ⅝ in.	0.020-0.025 in.	1/32 in.
to 1½ in.	0.025-0.030 in.	1/32 in.
to 2½ in.	0.035-0.040 in.	3/64 in.

Chamfering the scale corner at *R* to clear radius makes it easier to read the scale accurately. Dimension *B* can be greater than the non-cutting minimum and, therefore, could be gaged by sight. This procedure, however, would result in less grinds per chaser. It can be seen that the same principle of end grind to produce the non-cutting teeth, and the parallel rake grind for parallel bearing of the cutting edge, is used on tangents without helix as well as those with helix. The procedure and result is the same, but the method is somewhat different because the helix is on the holder instead of in the chaser. The parallel rake grind is commonly used on tangents, with or without helix, because it is easier to control and works on the great majority of jobs.

It is sometimes found advantageous to rake grind short-chamfered chasers out-of-parallel towards the cutting edge as shown by line *S*, Fig. 42. This has the effect of lengthening the chamfer cutting edge slightly and reducing the bearing on the leading cutting edge. However, the out-of-parallelism should not be too great or it may cause chatter or drunkness because the bearings are too light. Operators should adhere to the parallel rake-grind until they are thoroughly familiar with both the principles and applications of the other method. Sometimes an off-parallel grind on very coarse U. S., acme, or worm forms helps produce a more equal finish on both flank of the thread.

Fig. 48*A* shows the tangent with the parallel rake-grind as represented by line *C* on tangents with helix. It can be seen that the angle *E* (cutting edge *C* to helix of the thread) presents a sharper cutting point *E1* to the stock than does angle *D* as represented by point *D1*.

This will help the leading flanks *E2* since they have a sharper angle, produce a somewhat smoother finish than trailing flanks *D2* which do not have so sharp an angle.

Fig. 48*B* shows the right off-parallel grind to its maximum efficient off-parallelism. Theoretically, if angle *O* of the cutting edge *Z* is equal to the helix, on tangents with helix, then angles *K* and *J* will be equal, and both flanks would be of equal sharpness and produce the same degree of thread smoothness. On tangents without helix, angle *O* would be zero since the helix on the holder turns the chaser to the thread helix.

Although the off-parallel grind may seem the most efficient, in practice the maximum off-parallel rake grind is seldom used and should not be attempted by anyone who is not thoroughly experienced in handling chasers.

It should be remembered that sharpening any type of chaser must necessarily result in a compromise for the best results. Any factor of sharpening that benefits one phase of the chaser performance invariably is detrimental to another. This is true of the off-parallel rake grind. The advantage of more even smoothness is offset by the trouble involved in setting the chaser cutting edge relative to the cutting center as well as

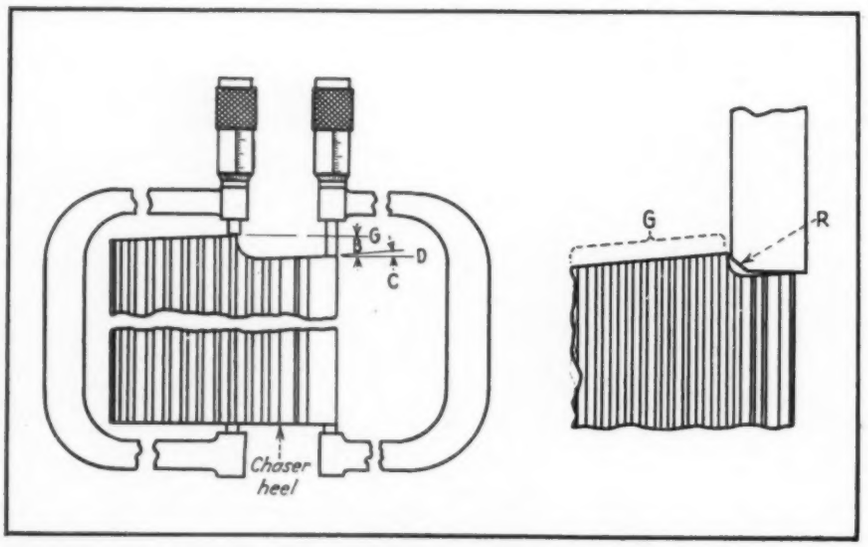


Fig. 47—Micrometer and scale measurements of the end grind (non-cutting) bearing on tangents without helix

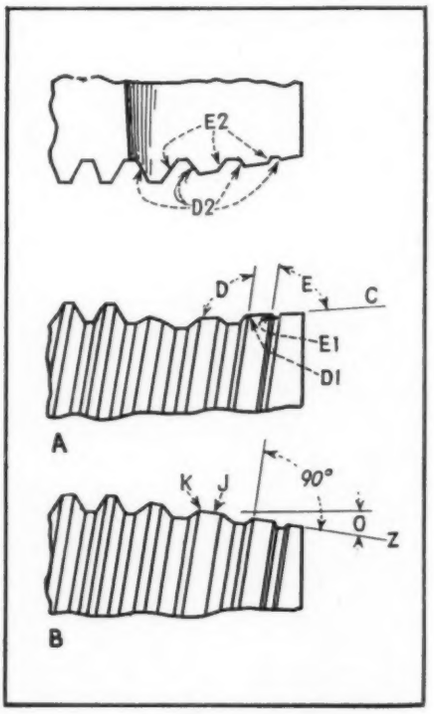


Fig. 48—Effect of the parallel rake grind *A* and the off-parallel rake grind *B* on the relative sharpness of the cutting teeth flanks

by the difficulties experienced in trying to measure and control the cutting bearing. This is true of tangents with and without helix.

Fig. 49 shows the conditions of varying bearing along the cutting edge that would make it extremely difficult to check, control and set relative to the plane of the cutting center.

Studying the side and front views, a top rake of *Z* will produce a bearing having portion *A* of the chamfer behind center. With a top rake of *Z'* all of the cutting edge will be ahead of center with a minimum bearing of *B*. With a top rake of *Z"* all of the cutting edge will be ahead of center with a minimum bearing of *C*.

The bearing on this grind is affected not only by the top rake but also the length of chamfer and the helix angle. It is, in practice, seldom that angle *O* (Fig. 48) can be made as much as the helix angle because, combined with the top rake and chamfer angle, there is too much variation of bearing along the cutting edge from *E* to *F* (Fig. 49).

The end grind is done the same as on the parallel grind. If and when the off-parallel grind is used, it should be attempted only on coarse pitches of steep helix and as a last resort. Only thorough understanding of chaser principles and their practical applications will assure any degree of success. The parallel rake grind should be used on tangent chasers that cut straight threads. It produces a good finish on the great bulk of threading and is easier to handle and control.

Leadscrew Controlled Chasers

When a leadscrew is used the chasers get their lead from the leadscrew and not the guiding action of the non-cutting chaser teeth; therefore, it is usually not necessary for the end grind to produce a non-cutting bearing. Both the parallel rake grind and the full rake grind, Fig. 43, can be used. The parallel rake grind is preferable because it is easier to control particularly when a bearing measuring gage is provided. The end and rake grinds on tangents with and without helix are done in exactly the same manner as on the chasers that control their own lead.

With a leadscrew to control lead, the end grind does not have to be so far above center that it cannot cut. The bearing is ground equal or a few thousandths heavier than the rake bearing. In other words, if the rake grind is to be 0.006 in. above center, then the end grind is made 0.006 in. or a few thousandths more above it.

The top rake of the end grind can be somewhat less than that of the rake grind, or the same top rake can be used on both, dependent on which is easier with the available grinding equipment.

For use with a leadscrew, chasers with and without helix can be ground with a full rake grind, Fig. 43*B* that is, with the rake ground the full width of the chaser.

To find and control the cutting action of the full rake grind is more difficult than with the parallel rake grind. The parallel rake grind is recommended when using tangents controllable for lead by a leadscrew. The standard parallel rake grind, as used without a leadscrew, is sometimes also used with a leadscrew.

Sharpening Taper Cutting Chasers

Since in the receding diehead, the chamfer and first full tooth of the chaser produce the thread as the diehead opens up on the taper, the chasers can be ground the same as for straight cutting chasers.

The average diehead is of the non-receding type; therefore, for taper threads all the teeth of the chaser cut. This is called a plunge-cut taper chaser.

On straight cutting chasers, there are the end grind (lead control teeth) and the rake grind (cutting teeth). On the plunge-cut taper chaser there is no end grind. The full rake grind, Fig 43 *B*, is used there.

The chasers can be ground square across or with reverse angle so that tooth *J* is slightly more above center than tooth *K*. The reverse angle of the rake grind *A* for tangents with helix would be the same as for the radial chaser as given in the preceding article under plunge-cut chasers, that is, approximately ½° for ¼ to ¾-in. taper pipe, ¾° for ¾ to 1½-in. pipe and 1¼° for 1½ to 3-in. pipe. These figures are not critical and can be measured close enough with the common bevel protractor.

On chasers without helix, the total reverse angle would be the helix of the thread plus the reverse angle given above. For example, if the helix of the thread is 2½° and the thread is ½-in. pipe, then the total reverse grind would be 2½° + ½° or 3°.

The bearing (distance above center) should be checked at the first full tooth on chasers both with and without helix. The top rake will, of course, be whatever the material requires.

Some difficulties may be encountered with tangent chasers of certain design because the design of the diehead, chasers, and sharpening equipment do not provide means for positively setting the chasers in the diehead and measuring the bearing during resharpening.

To produce threads to a Class 3 tolerance, dieheads and measuring

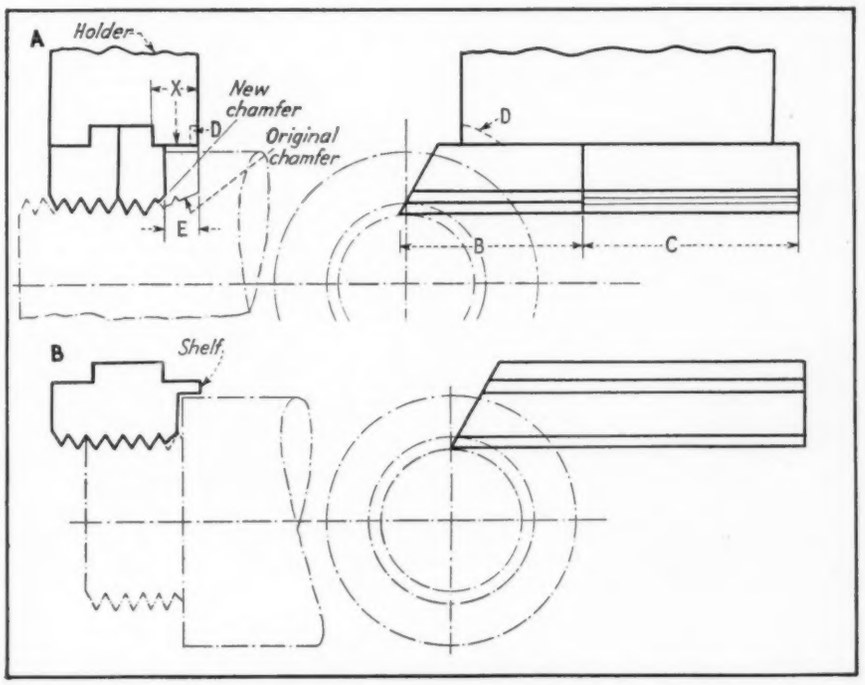


Fig. 49—Effect of off-parallel grind is to give a varying bearing along cutting edge

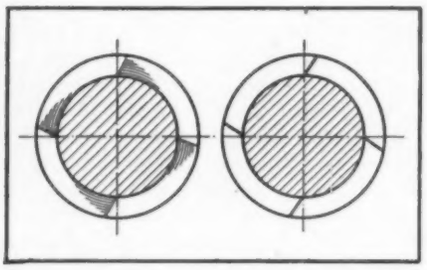


Fig. 50—Marks on flanks of the screw thread indicate insufficient bearing of end grind to make full teeth non-cutting

and grinding equipment must be so designed as to make the chaser sharpening and setting in the diehead a positive procedure and not dependent on the operator's feel or judgment. If not so designed, the result will be constant variation in the quality and quantity of the threads produced as well as downtime.

Result of Insufficient End Grind

If the end grind is not sufficiently above center, the guiding teeth will side trim or shave with the same results of off-lead, poor form, drunkenness, taper and poor finish as produced on the radial chaser by the same condition. Although it may use up a little more chaser, it is always well to have the end grind enough above center so that it is a certainty that it will not cut. Excessive bearing on the end grind rarely, if ever, causes any trouble. However, insufficient bearing always causes trouble.

Insufficient end grind bearing will show up on the chaser guiding teeth by a frost along the teeth flanks the same as shown for the radial chaser. Fig. 50 shows two results of insufficient end grind bearing. The guiding teeth may leave nicks, Fig. 50*A*, on the thread flanks during the pull-off because of insufficient end grind bearing. An aggravated condition *B* is traceable to the same cause. The guiding teeth have dug into the flanks of the threads.

Changing the Chamfer Angle

It is comparatively easy to lengthen the chamfer on a tangent chaser. However, shortening the chamfer is a different story.

Unless in urgent need, shortening the chamfer should not be attempted. When it is done it should be done with care especially to see that the chaser is held lengthwise from the same positioning surface by which it is located in the chaser holder. The new chamfer should clear the root line of the chaser teeth by at least 0.005 in.

Fig. 51 shows two ways in which the chamfer can be shortened provided the difference between the root diameter of the thread and the outside diameter of the shoulder does not exceed the thickness of the chaser.

Fig. 51*A* illustrates how the chaser must be reworked for rechamfering when the shoulder height is almost as much as the chaser thickness. The chaser is cut in as at *E* for a distance back along the chaser length equal to *B* required to clear the circumference of the shoulder. The distance *C* is the original chaser chamfer.

The amount *B* that the cut-in *E* is carried back along the length of the chaser depends on the amount of difference between the original chamfer and the new chamfer. If the original chamfer was 30° and the new 40°, the difference would be so small as not to decrease greatly the chaser locating surface *X*. In this case *B* could be the full length of the chaser.

However, if the original chamfer was 18°, and had to be changed to 35°, then so much of *X* might have to be cut away as to leave practically nothing for support at *X*. Therefore, cut-in *E* is cut back a distance only of *B* so that the chaser will have support at *X* for the length of *C*.

The lower view *B* shows how the chaser is reground for a shorter chamfer when the shoulder diameter is small enough to allow for a shelve grind. The cut-in in this case is carried the full length of the chaser. Always rechamfer the chasers locating from those surfaces on which the chaser located in the chaser holder.

When the difference of root and shoulder diameter is greater than the thickness of the chaser, it is sometimes possible to face the holder as shown at *D*. Fig. 51*A*. This can be done only when the cut-in *E* is only a small amount.

The rechamfering should be based on the chaser having the first full tooth farthest from the leading edge of the chaser. As on the radial chasers, *E* should be ground first and then the chamfer.

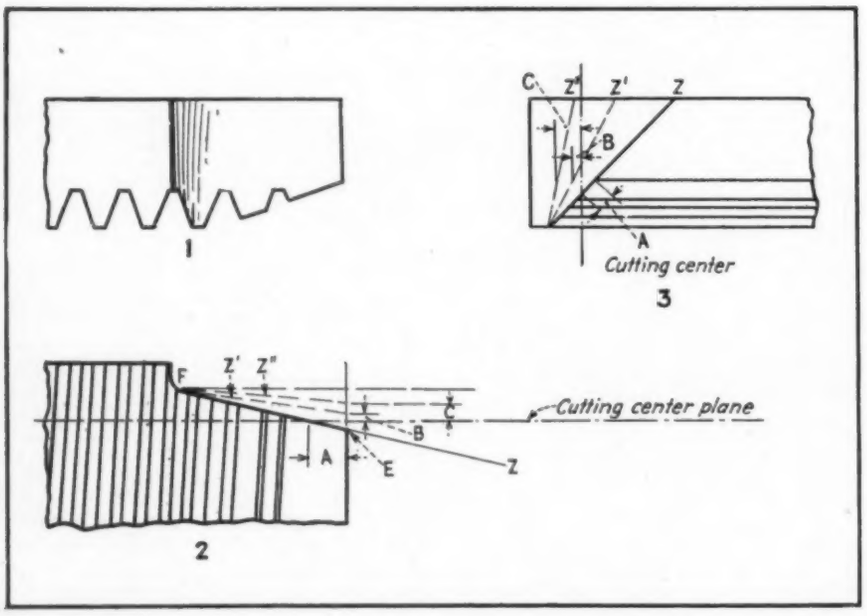


Fig. 51—Emergency methods of short chamfering long chamfered tangent chasers

Soviet Auto Industry Makes Machine-Tool Plans

LOOKING AHEAD technologically, the Soviet Union's automobile industry plans wide-scale use of the latest in multiple-head and specialized machine tools, of which a minimum of 5,000 is to be supplied by Soviet machine-tool works.

Other important items are improved factory routing and the automatization of production lines, as well as extensive use of such processes as high-speed milling and grinding, high-speed die pressing instead of forging, centrifugal castings instead of hot stamping, and high-frequency tempering of parts.

Experimentation facilities and laboratories at the auto plants are likewise scheduled for expansion and development. The five-year expansion plan means that supplier and allied industry will be compelled to take steps to increase output.

Practical Ideas

HAVE YOU A PRACTICAL IDEA?... If so, send it in. Your idea will help other men, in other shops, who have a problem similar to yours. We pay for acceptable contributions prepared exclusively for this publication

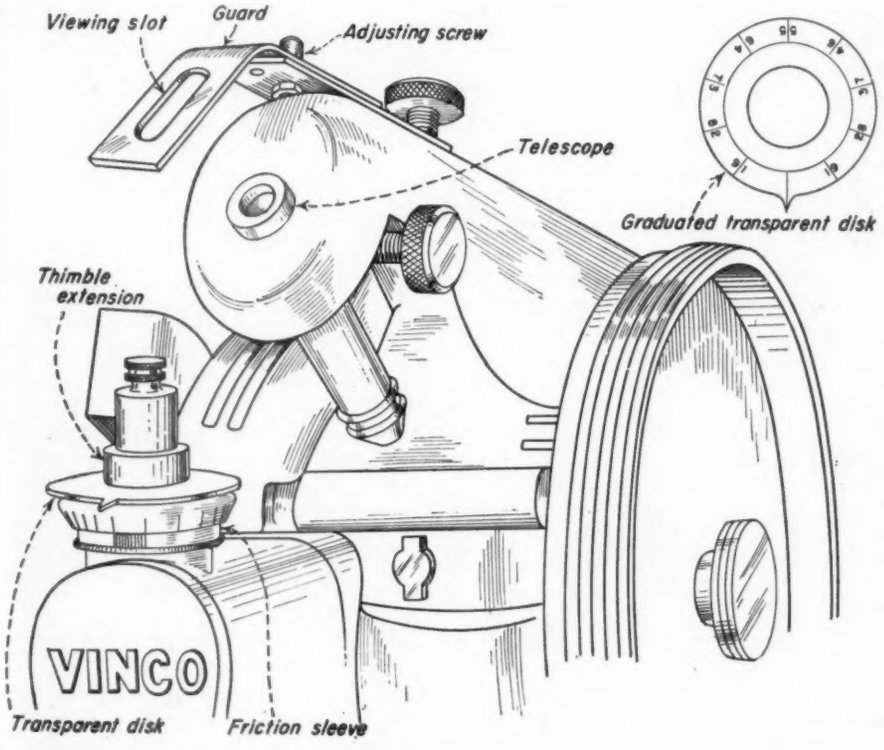
Microscope Guard and Graduated Minute Scale for Vinco Head

LOUIS DeL. BERG

The manufacturers of the Vinco Dividing Machine have informed me that these modifications have been incorporated in their latest models, but users of the many older instruments, can bring theirs up to date easily.

The microscope guard is a bent piece of steel strip with an aperture to view the eyepiece and an adjustable slide to permit focusing adjustments. Although the machine deserves, and usually gets, the gentlest care, it is very easy to brush accidentally against the projecting scope and throw it out of focus. With the guard, the annoying nuisance of refocusing is eliminated.

On the early models of the Vinco Dividing Head the minute divisions on the micrometer thimble are all marked 0. The customary method of using the head is to set it at zero degrees and then turn the friction sleeve until the 1/10 minute scale coincides with two of the minute divisions on the thimble. Measurements are then taken from this zero setting by turning the micrometer until the microscope eyepiece crosshair coincides with the nearest line on the drum of the head. While this is being done, it is necessary to note how many of the minute divisions on the thimble pass the zero of the 1/10 scale, as well as to count the complete ten-minute revolutions. In order to avoid confusion as to which of the minute divisions is the starting point, it is customary to mark with a soft pencil or crayon on the top face of the thimble at the zero setting and erase the mark after taking the reading. However, these marks are very likely to show after erasure, unless very carefully cleaned off, and cause confusion as to just which is the proper mark to use.



Old model dividing head equipped with microscope guard and graduated micrometer disk

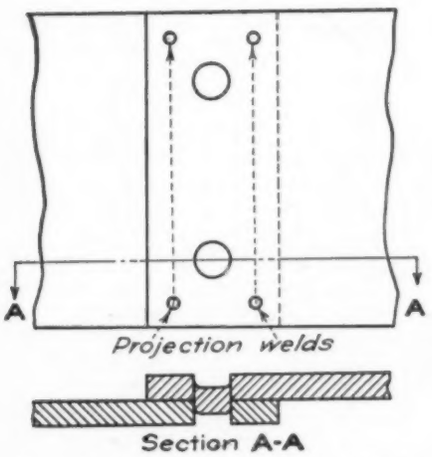
To do away with the necessity of marking the thimble, a friction-held plastic disk, about 1/16 in. thick, was slipped over the extension of the thimble. This disk is shown in detail at the right. It is divided into ten parts, each part representing one minute, and the divisions numbered from one to ten in both directions. The bore or inside diameter is such that it fits snugly on the extension but not too tight to prevent its being turned on the thimble. One advantage in making the disk of plastic lies in the fact that if bored out too large it can be made to fit with the desired tightness by staking around the edge of the bore until just the right fit is obtained.

Now, the thimble and minute scale are set at zero as previously explained and then, while the thimble is held in its zero position, the disk is turned until the pointer is brought opposite the zero position of the scale. The measurement is taken by setting the micrometer, and the minute readings obtained from noting how many division the plastic pointer has moved away from the zero setting, counting in the direction of rotation. Seconds are obtained from the 1/10 minute scale in the regular manner. When setting the micrometer, the number of complete revolutions must be noted and ten minutes added for each revolution.

Half-Punching One Member Eliminates Dowel Pins

HOWARD C. DE HEER

Many types of precision assembly require dowel pins for accurate alignment in addition to the fasteners. Here, two sheet metal parts are to be joined by projection welding. Inasmuch as they are pressed steel parts anyhow, we hit on the idea of including alignment punching in the press operation, and to make the idea really good, the top member was deliberately punched only halfway through. Of course, with the holes in the parts carefully set up, there was no chance of occasional errors, but best of all, the necessity for time-wasting fumbling with dowels was eliminated.

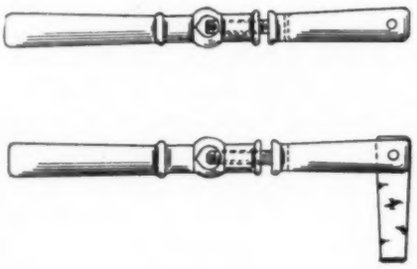


Two large holes punched during the regular press operation align two pieces accurately for assembly; the top piece is only half punched, leaving a slug to fit the lower hole thereby eliminating other locating pins

Tapwrench Has Built-In Jacknife Tightener

A. M. SCHWEDA

Most tapwrenches are one of two types and each has disadvantages. This design, at first glance looks like a conventional tapwrench but its hidden folding lever is a big improvement. The tap or other small tool can be very securely fastened without the inconvenience of resorting to other wrenches or vises, and its compactness when closed makes it easy to use and store.

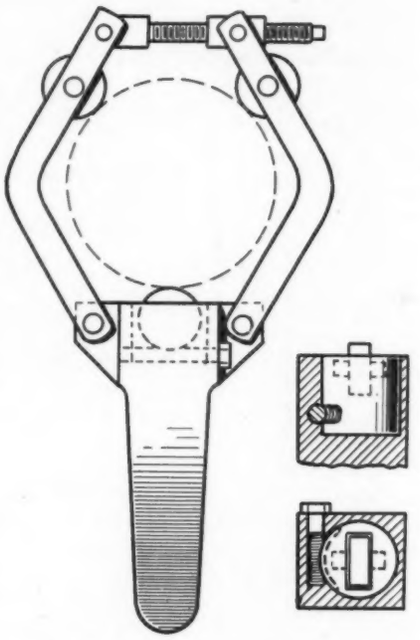


Single-Screw Triple Roller Burnisher

J. W. ANDERSON

Having noticed the triple-roller burnisher used by the Pennsylvania Railroad described in "Practical Ideas" a few months ago, I decided I ought to submit my version of substantially the same tool.

The chief difference is that a single, right-hand screw replaces the left-and-right-hand screw, and the Y is eliminated, thereby simplifying construction. Also, though the forces on the screw are about the same, the two arms carry very little tension stress and practically no bending stress. This makes smaller pins and arms possible, permitting a much lighter tool for any size of work.



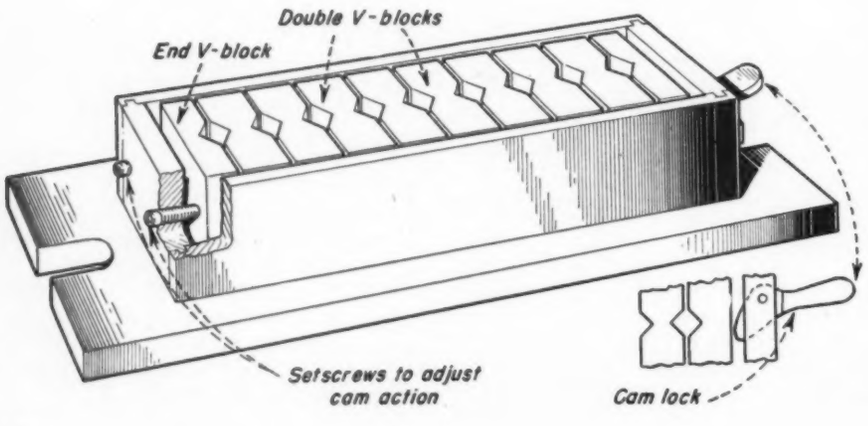
Side-thrust on crossfeed, ways, and lathe spindle is eliminated by employing the action used in constriction-type tube cutters

V-Block Fixture Holds Round and Square Stock

MICHAEL AXLER

We had to slot the heads in a large quantity of bolts. At first, the setup was made using the dividing head, slotting the bolts one at a time. Then, we designed this box fixture which cut the time at least 75%. Now, eight to ten bolts can be cut in the same time that was formerly required to set up and cut one.

The fixture consists of a box-frame attached to a base and having a cam-clamp at one end and take-up set-screws at the other. Filler-blocks, V'd on both sides, except the end ones, V'd on the inside only, make it possible to hold simultaneously as many pieces as there are square slots. If the blocks are accurately made, with ground perpendicular notches, precision work can be done in a simple and fast-operating fixture. Further, by leaving the construction simple, it is possible to adapt the fixture to a wide range of work.

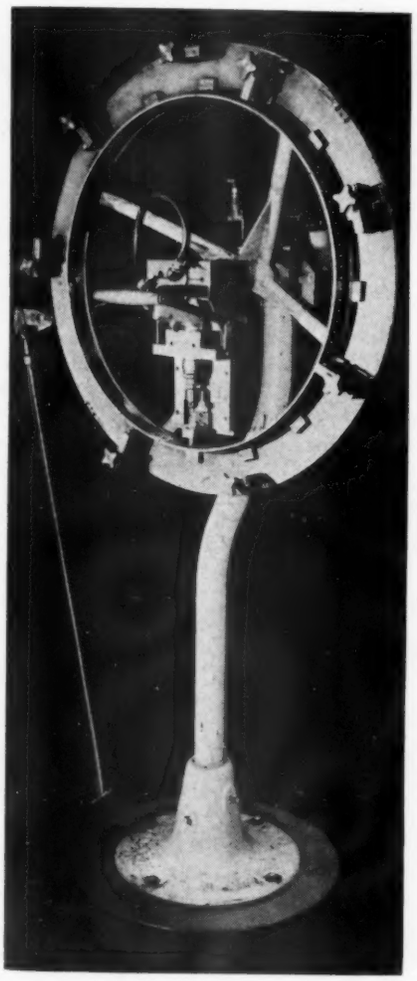


Ring-Drilling Machine Employs High-Speed Air Turbine

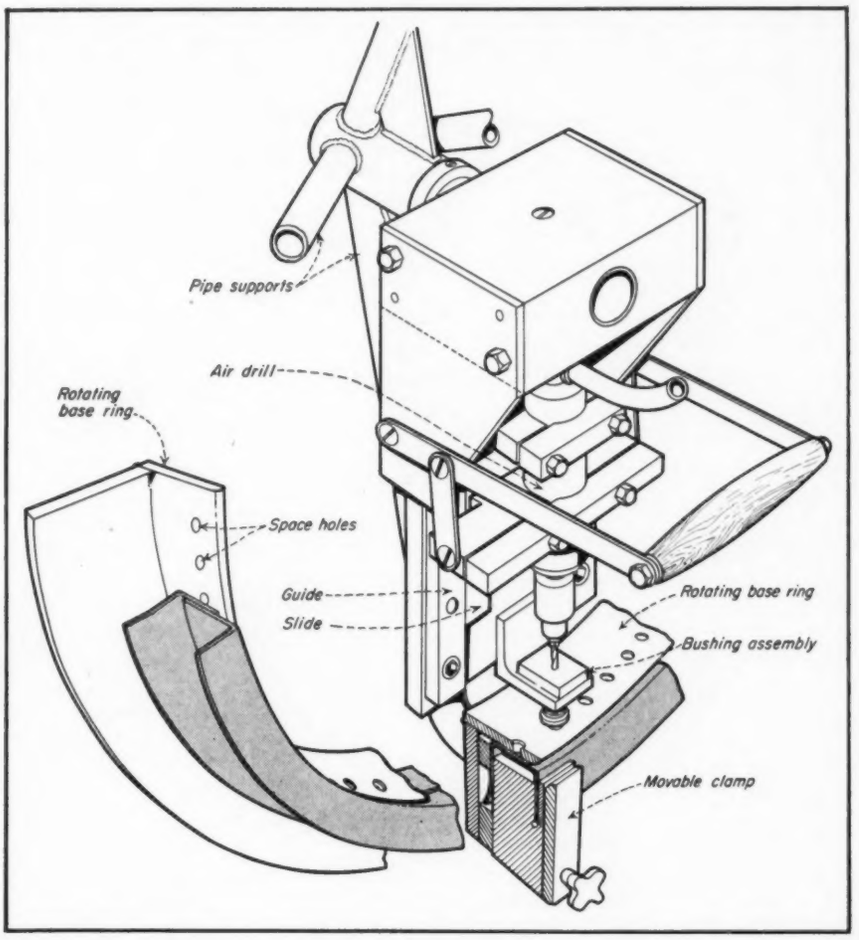
ARTHUR G. MEANS, JR.
Chief Assembly Tool Engineer
Boeing Aircraft Company

Two aluminum angles, each bent into circular rings, had to be assembled in an aperture to make a circular door frame. The solution to the drilling problem, affording quick and accurate clamping of the components and assuring parts which will fit together during installation, resulted in an easily built-up machine suitable for many other jobs of this nature.

A rotating base-ring fixture, supported on four pipe-spokes and a sleeve hub, becomes the foundation for the eight movable workclamps. The hub of the "wheel" is set back, and the spokes lead in at an angle to permit the drill mounting to fit on the stationary axle also, and to have the drill axis come close enough to drill the work at the proper distance from the face of the ring.



Lightweight pedestal mount makes this wheel jig-drilling fixture ready for use anywhere. Incorporating a clamp-guide-feed mechanism for a portable drill makes a complete unit



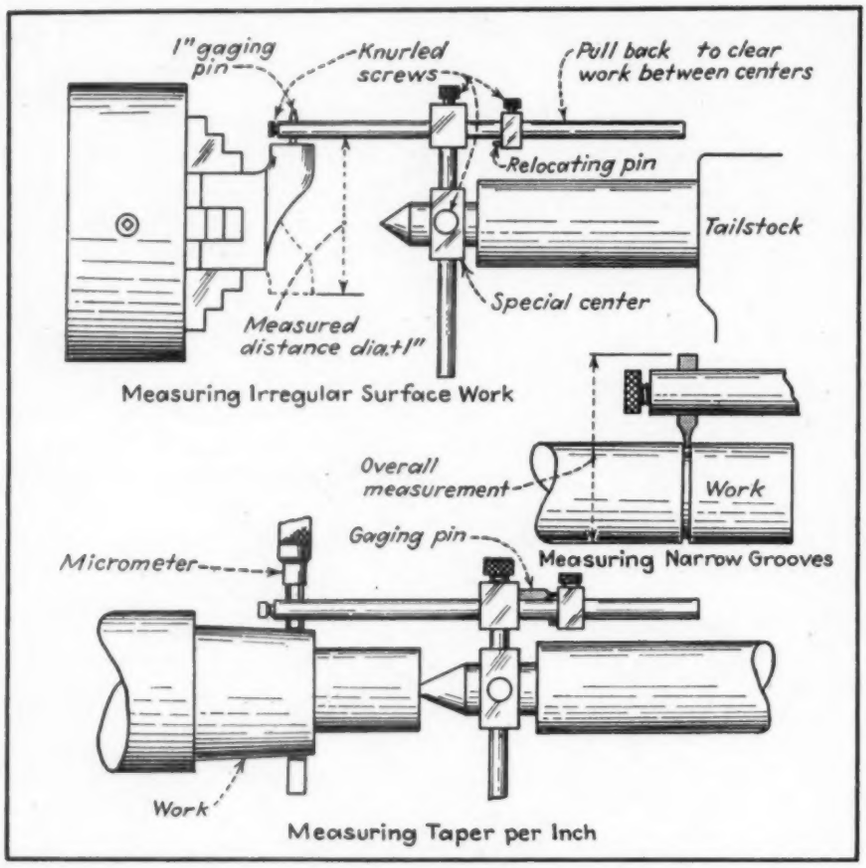
A flat slide, moving vertically in 30° guides, is provided with drill-holding clamps, hand feed links and lever, and a bushing assembly which moves with the drill

The motor is mounted on a slide-plate by two clamps, the extended lower clamp receiving shoulder-screws to which the feed-handle links are attached. The slide, with 30° beveled edges, travels in fixed vertical guides.

Accurate location of the jig-wheel with relation to the drilling-unit mount is obtained by mounting a heavy steel support plate on the outer end of the horizontal shaft of the pedestal support unit. To this are fixed two ¼-in. steel side plates onto which the vertical baseplate of the drilling unit is bolted and doweled. This method gives a sturdy mount.

The end of the index bushing is tapered, and it is aligned with holes around the circular jig plate. The index bushing slides vertically in the bushing support assembly so rotation of the jig-wheel forces the bushing against its spring out of the hole in the circular drill plate and into the next hole when the jig-wheel is revolved. In the fixture shown, the jig-wheel assembly is indexed by a treadle-operated ratchet, but in other units the assembly is turned by hand.

Both air and electric portable drill motors have been similarly employed, and in some instances Govro-Nelson electric drillheads with built-in centrifugal automatic-feed mechanisms have been employed. In these cases, either hand-operated pushbuttons of automatically-operated limit switches control operations. Any portable drill can be used without alteration, permitting higher availability according to job requirements.



Special center, two rods, collar, setscrews and a 1-in. gaging pin combine to solve three of the difficult lathe-measuring jobs. Top, measuring the "swing" of a projection; center, the diameter of a narrow groove; bottom, a short taper

Lathe Attachment Measures Awkward Jobs

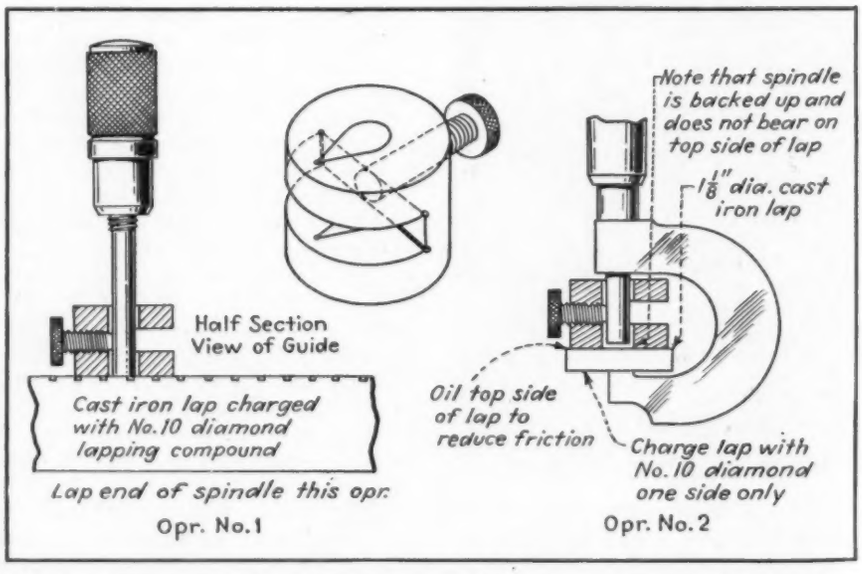
H. MOORE

Although the range of modern standard measuring tools is wide, there are occasions still when their application is virtually impossible without the assistance of subsidiary devices. Micrometers cannot be used alone for measuring the diameter of work which does not offer opposite points of contact; bottom diameters of very narrow grooves cannot be reached by any existing manufactured tool; taper-per-inch measurements require a combination of tools. There are other instances but inasmuch as these three are the most frequently encountered in my own lathe work, I decided to tackle them together and use one device for the lot. The result is shown in the accompanying drawings, which illustrate all three uses.

A special center was made first. This was turned from oversize stock (could be hex or square) leaving an enlarged area for the diametrical hole and the setscrew hole. A rod with a shouldered and bored head was made to slide in this hole and another rod furnished to slide horizontally, parallel with the center. This combination thereby provides adjustability in two directions. The last, but vital piece of equipment is the hardened toolbit ground to make a 1.0000-in. gaging pin narrowed to about 1/16 in. wide for entering narrow grooves.

To measure a crank throw or swing, turn the lathe until the work is as high as it will go; advance the horizontal rod (with the locating pin engaged in the collar) and drop the vertical rod until the maximum measurement is found. Without disturbing the setscrews, slide the rod clear and rotate the lathe 180° so an outside micrometer caliper will be able to span the crank and reach the outside of the gaging pin when the rod is moved back in place and relocated exactly with the locating pin. The measured diameter, then, is the swing plus one inch and the throw will be: (measured diameter minus 1) divided by 2. The application to circumferential or longitudinal grooves is similar but much simpler. It is again, a combined measurement of the diameter of the work, minus its groove on one side plus 1 in., so the groove equals the outside diameter plus 1 minus the measurement.

Short tapers are easy to measure with the micrometer spindle clamped in the end of the horizontal rod and moved 1 in. longitudinally with the gaging pin.


Half Section View of Guide
Cast iron lap charged with No. 10 diamond lapping compound
Lap end of spindle this opr.
Opr. No. 1
Note that spindle is backed up and does not bear on top side of lap
1 1/8" dia. cast iron lap
Oil top side of lap to reduce friction
Charge lap with No. 10 diamond one side only
Opr. No. 2

Left, lapping an outside micrometer spindle; center, perspective of lapping block; right, reassembled mike has its fixed angle lapped

Another Micrometer Lapping Block*

H. A. SIMONSEN

For a long time, I have been using a micrometer lapping block similar to the one which appeared in *Practical Ideas* recently. I feel that mine possibly is a trifle easier to make and use and certainly is just as accurate. The clamping surface is one 60° Vee, relieved at the bottom and cut away horizontally through the middle. A single ¼-28 knurled screw grips the spindle, and the clamping pressure is distributed over both portions of the interrupted Vee.

Making the block: Class 5 steel was used and piece turned to 1⅛-in. diameter in a lathe. Holes are spotted on a layout table. A drill press then drills the 1/16-in. relief hole, the 9/32-in. center hole and the setscrew hole. A slotter roughs out and a 3-cornered file smooths the 60° Vee. Next, the center slot is milled, chiefly to reduce the surface which will have to be lapped. All corners are rounded to prevent hardening cracks. The piece is hardened. A three-cornered cast-iron lap finishes the Vee and the piece is then squared up in a surface grinder at right angles to the Vee and lapped.

I use small cast-iron disks for laps; these are 1¼ in. in diameter and ¼ in. thick lapped parallel, and checked with a Sheffield electric comparator to within 0.000005 in. No. 10 diamond compound is used for all lapping, and I hold caliper frames in my hand as it seems to give a better "feel." Also, a straight back and forth motion seems to give a finer finish than circular motion, but it is always imperative, in any case, to wash the lap with solvent every few passes to prevent loading and possible scratching of the work.

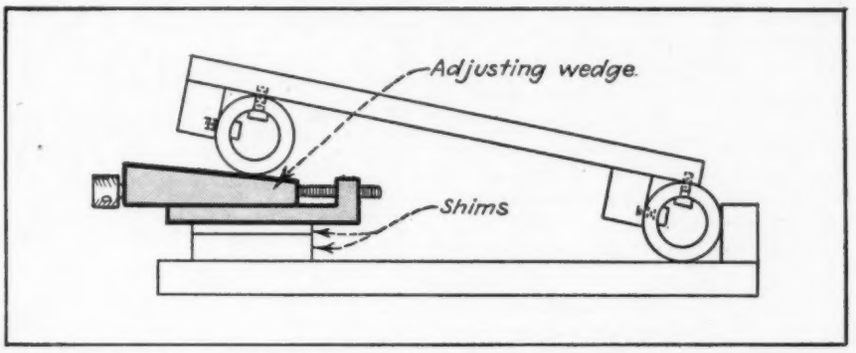
This is very delicate work and practice is about the only way to achieve satisfactory results.

*(While substantially similar to the design described by first prize-winner R. B. Taggart several issues back, this item contains additional specific information.—*Editor's Note*)

Adjusting Wedge for Heavy-Duty Sine Bar

JOHN ROBERTS

The piston-pin sine bar described recently in *Practical Ideas* recalls a simple wedge which would seem to suit this job well. When work is to be milled or ground using the sine bar as the fixture, it's not exactly best practice to allow the gage blocks to take the load. With the wedge, the height can be transferred easily and accurately and the blocks removed to prevent accidental damage. Shim the wedge from beneath until it is nearby touching the pin and clamp it to the base; then draw the wedge in with the screw, and when contact seems imminent, move the blocks slightly and determine by feel when the wedge takes over the weight.



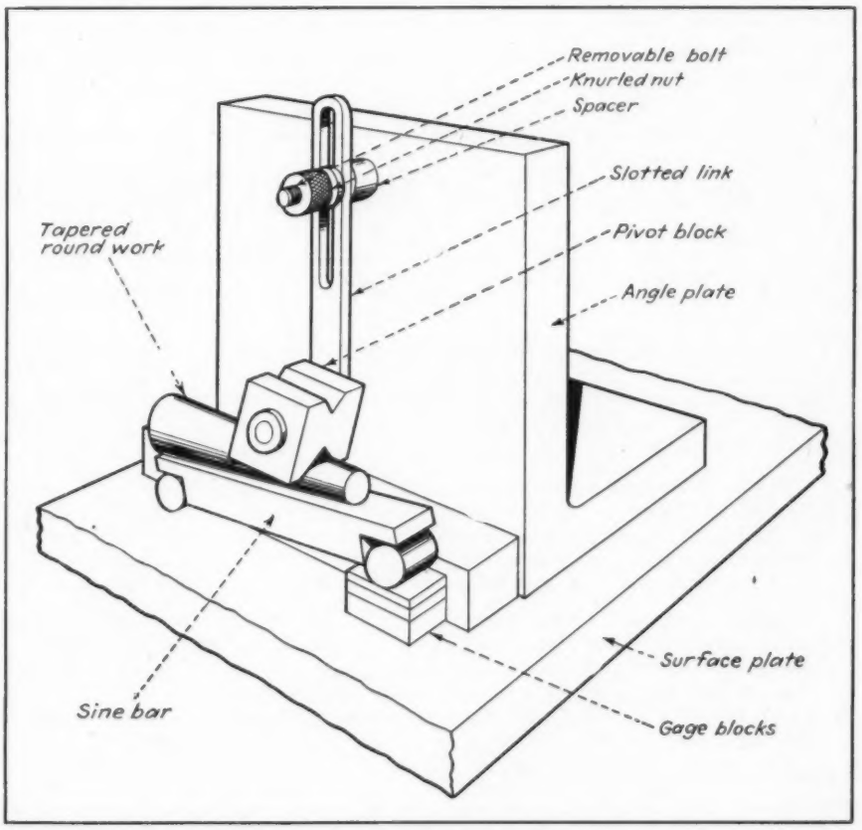
After setting the angle with gage blocks the load is shifted to the draw-in wedge thereby protecting the blocks

Pivoted V-Block Aligns Round Work on Sine Bar

LOUIS DeL. BERG

Difficulty is often encountered in using a sine bar to check the angle of taper pins and similar small parts unless the work is held on special centers designed for this type of work. Holding these parts accurately at right angles to the axes of the rolls is what causes the trouble.

My solution was to use an angle plate in conjunction with the sine bar with an accurate pendulous, pivoted



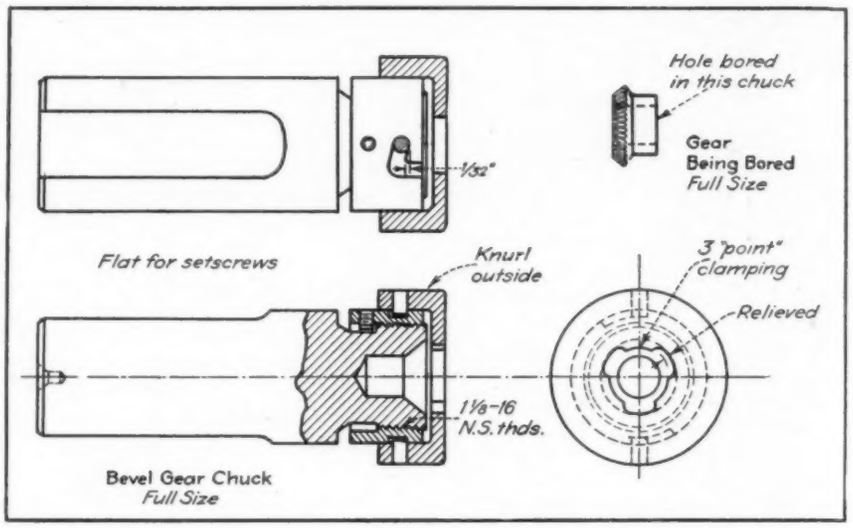
A pivoting V-block accurately lined up at right angles to the sine bar rolls provides an easy way to hold and inspect taper pins

V-block. A hardened pin is fitted to the angle plate, perpendicular to the plate and held with a nut. The pin is shouldered and its outer end is stepped to hold the sliding bar at a fixed distance away from the plate. The bar is slotted full length to fit the shouldered pin and a thumbscrew holds the bar at any desired position, and at the lower end of the bar there is a pivot pin for the V-block. The latter has a large and a small 90° Vee to accommodate a wide range of diameters. The axis of the Vee should be, when assembled, accurately parallel with the vertical surface of the angle plate, and the sine bar is placed against the angle plate, or at the required distance from it with ground parallels, and the angle plate keeps the V-block and sine mutually parallel. (It is assumed that the sine bar is ground square.)

Checking any conical piece consists of clamping it firmly against the sine bar with the V-block attachment, after first elevating one of the rolls to bring the top surface of the work approximately level.

A height gage then checks both ends of the work, and more adjustments and rechecks are made until the reading is zero with everything securely held.

The removable shouldered pin frees the plate for other work.



Gear teeth rest on the countersunk surface while cap tightens against back

Quick-Acting Chuck For Boring Bevel Gear Hubs

JOSEPH F. BUDNICK

This quick-acting chuck, combining the advantages of the bayonnet lock, and screw-thread tightening, clamps small bevel gears precisely so their hubs can be lathe-drilled and reamed.

The gear is held teeth inward, against the countersunk hole in the chuck-body with the pressure of the nose-cap.

The unit consists of three parts: the chuck-body has threads on its end to receive the tightening ring, which, in turn, is slotted to take the diametrically opposite pins in the cap.

To chuck a gear, place it hub outward into the cap from the inside; slip the cap into the slot and turn to the right about ¾ turn. This does two things; first, it hooks the pins in the slot, then it advances the screw-sleeve until clamping is complete.

NOW . . . $25 for the best Practical Idea in each issue

Jury of readers, different each time, to select top suggestion. Anyone with an idea can enter

Until further notice, an extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

Payment—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in a tie, duplicate payments will be made. Judges' decisions are final in each case.

Requirements—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

Who May Enter—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments.

How to Enter—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St., New York 18, N. Y.

Fourth Selection: Edwin Kraus on Radius Tool

Machining of Aluminum Alloys—I

Through the courtesy of the Reynolds Metals Company, portions of its forthcoming manual "Machining of Aluminum Alloys" are presented in condensed form.

WROUGHT aluminum alloys posses excellent machining characteristics, but the user can take best advantage of them through familiarity with recommended tool designs and practices. The properties having a bearing on machinability are:

1. High thermal conductivity.
2. Low resistance to penetration.
3. Relatively low notch-impact strength.
4. Low modulus of elasticity and low modulus of shear.
5. High coefficient of friction on steel.
6. Lightness, which reduces inertia when machining large sections at high speeds.

These properties vary considerably with the different alloys.

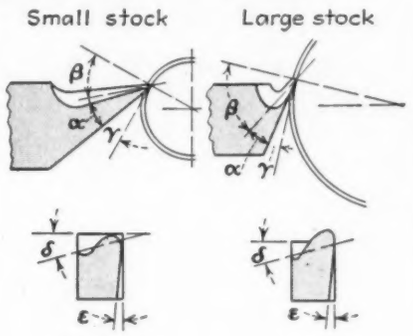
Micro-constituents present in the alloys affect machinability. If non-abrasive, such as those formed by copper, magnesium or zinc, they have a beneficial effect, whereas the abrasive variety, such as formed by silicon, reduce tool life and quality of finish. Others, which are both soft and non-abrasive, assist chip breakage.

Wrought alloys that do not respond to heat-treatment give continuous chips, offer little resistance to cutting, but require care to obtain good finish, because they are inclined toward gumminess. In full-hard temper the alloys are easier to machine to a good finish than when in the annealed state. The 2S and 3S alloys are the most gummy of the group, but good results can be obtained through the use of tools having large top rake and side rake angles, smooth properly finished surfaces, and keen edges. The 52S alloy does not machine to as good a finish as the 3S but is drilled more easily.

Most heat-treatable wrought alloys contain a fairly high percentage of copper, and can be machined to a good finish with or without lubrication. However, a good coolant-lubricant is recommended for most operations. Because of their high physical properties, these alloys offer more

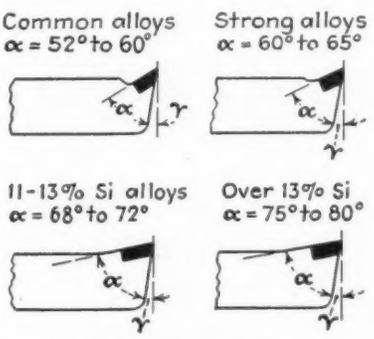
TYPICAL TOOL DESIGNS

I. High-carbon or high-speed steel



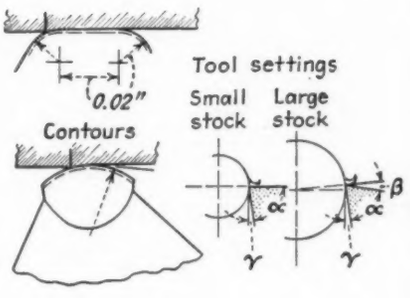
$\alpha = 30\text{-}50°$; $\beta = 53\text{-}30°$; $\gamma = 7\text{-}10°$
$\delta = 10\text{-}20°$; $\varepsilon = 7\text{-}10°$

II. Carbide-tipped tools



$\alpha = 52\text{-}80°$; $\beta = 32\text{-}0°$; $\gamma = 6\text{-}10°$
$\delta = 5\text{-}10°$; $\varepsilon = 6\text{-}10°$

III. Diamond-tipped tools



$\alpha = 74\text{-}90°$; $\beta = 10\text{-}0°$; $\gamma = 6\text{-}0°$

MACHINING DATA*

I. High-carbon or high-speed steel

Roughing

Alloy	Soft	Hard	High Sil.
Cut	0.250	0.200	0.120
Sfpm.	1600	650	400
Feed	0.050	0.007-0.020	0.007-0.020

Finishing

Alloy	Soft	Hard	High Sil.
Cut	0.040	0.020	0.020
Sfpm.	3500	2000	600
Feed	0.004-0.015	0.002-0.010	0.002-0.004

II. Carbide-tipped tools

Roughing

Alloy	Soft	Hard	High Sil.
Cut	0.250	0.200	0.012
Sfpm.	7000	1300	0.010
Feed	0.012	0.010	0.008

Finishing

Alloy	Soft	Hard	High Sil.
Cut	0.020	0.020	0.020
Sfpm.	8000	2500	1500
Feed	0.006	0.010	0.004

III. Diamond-tipped tools

Roughing

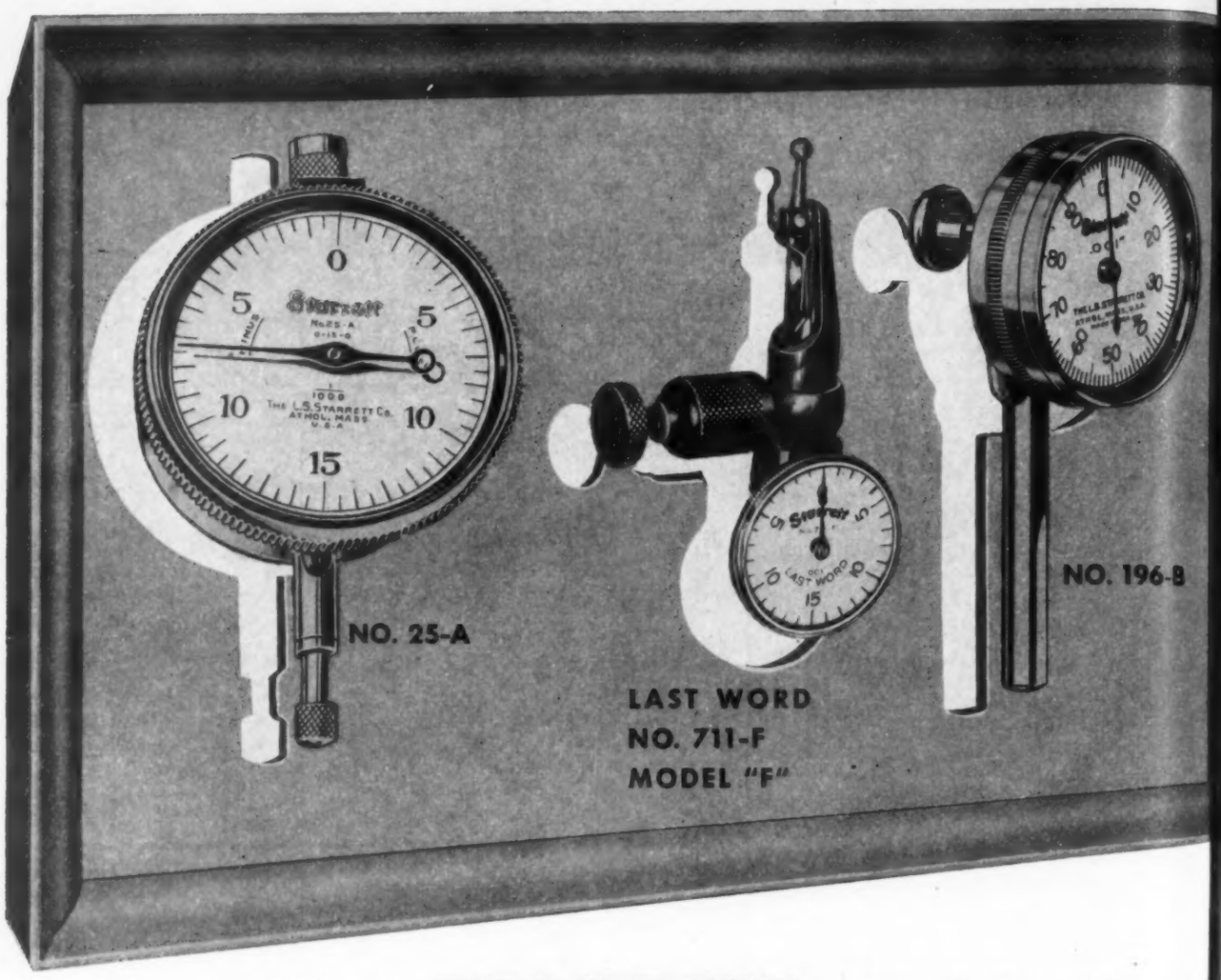
Diamond-tipped tools are not recommended

Finishing

Alloy	Soft	Hard	High Sil.
Cut	0.010	0.006	0.006
Sfpm.	Max. without vibration		
Feed	0.005	0.004	0.003

* *Maximum values given*

STARRETT TOOLS



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Machining of Aluminum Alloys—II

resistance to tool penetration than do the non heat-treated alloys. Chips usually come off in long continuous curls, except the free-machining materials which contain chip-breaker constituents. The R317T alloy, for example, is a high-strength, free-machining alloy, which is good for screw-machine production; also tapping, threading and general work. The 17ST and 14ST alloys give good finishes but at slightly more tool wear than R317T. These materials are widely used in screw-machine work. Chips are inclined to be long and curled, sometimes requiring reduction in feed and depth of cut.

The 24ST alloy has good machining characteristics; tool wear with this alloy is about equal to or slightly less than with 14ST. Chips are long and curled; smooth finishes are obtained with properly dressed tools.

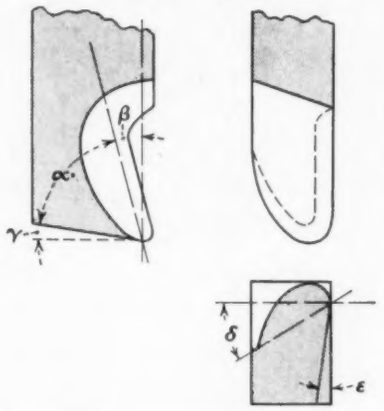
Greater resistance to tool penetration is offered by 53ST and A51ST, which are alloys of the magnesium-silicide group. However, by the use of properly prepared tools and good lubrication, fine finishes are obtainable with ordinary heavy cuts and feeds. The 53ST alloy finds a number of application in screw-machine products. Neither of the alloys can be drilled as easily or cleanly as the strong alloys mentioned earlier.

Alloys containing more than 10% silicon are the most difficult to machine, and none of those containing over 5% of silicon will finish to a bright lustrous surface. Chips are likely to tear rather than shear from the work.

Fullest economy in machining the aluminum alloys is realized by use of speeds that are extremely high in comparison with those used for other metals. In consequence, the equipment and work must be free of all vibration, tools should be supported close to the cutting edge and have keen edges, and no grinding marks, burrs or wire edges. Finishing tools having large top and side rake angles should be used only on machines which are free of vibration and lost motion in the feeding mechanisms.

TYPICAL TOOL DESIGNS AND MACHINING DATA

Roughing tool

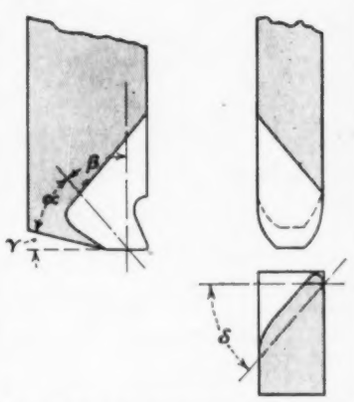


$\alpha = 64\text{-}71°$; $\beta = 19\text{-}10°$; $\gamma = 7\text{-}9°$
$\delta = 30\text{-}40°$; $\varepsilon = 7\text{-}9°$

Machining Data:

	Shaping	Planing
Cut	1/4" to max.	3/8" to max.
Sfpm.	Max. ram speed	Max. table speed
Feed	0.008-0.031	0.020-0.100

Finishing tool



$\alpha = 30\text{-}70°$; $\beta = 52\text{-}43°$; $\gamma = 8\text{-}10°$
$\delta = 50\text{-}60°$; $\varepsilon = 0$

Machining Data:

	Shaping	Planing
Cut	0.005-0.012	0.005-0.018
Sfpm.	Max. ram speed	Max. table speed
Feed	0.094-0.156	0.050-0.375

Tools of high-carbon steel are in fairly wide use for drilling, reaming and tapping small holes, particularly on the common alloys and the more free-machining strong alloys. High-speed steel tools give good results on all alloys except those of high silicon content, which are abrasive, but, of course, short runs of these can be handled. Tools tipped with cemented carbide remain sharp over a longer period, give good results on high-silicon alloys, many of which can not be machined successfully with other tool materials under production conditions. Diamond-tipped tools are used exclusively for special finishing cuts, especially to secure fine finish on high-silicon alloys. Circular and faceted cutting edges are used. With the faceted type, there may be five facets on one cutting edge, each varying from 0.02 to 0.06 in. Negative rake, if used, should not exceed 6°.

While many aluminum alloys can be machined dry, it is good practice from the standpoint of tool life and finish to use coolants and lubricants copiously. The thermal coefficient of aluminum is approximately twice that of steel or brass. Hence, if a considerable temperature rise is permitted during machining, the expansion of metal turned between centers may throw a severe strain upon the machine and may result in undersize workpieces. Proper choice of lubricant is determined by several factors. Where surface speeds are low and cuts heavy, the compound should have lubricating qualities to reduce friction between tool and work, with cooling as a secondary consideration. On the other hand, on finish cuts where surface speeds are very high and cuts are shallow, coolant characteristics are more desirable.

(To be continued)

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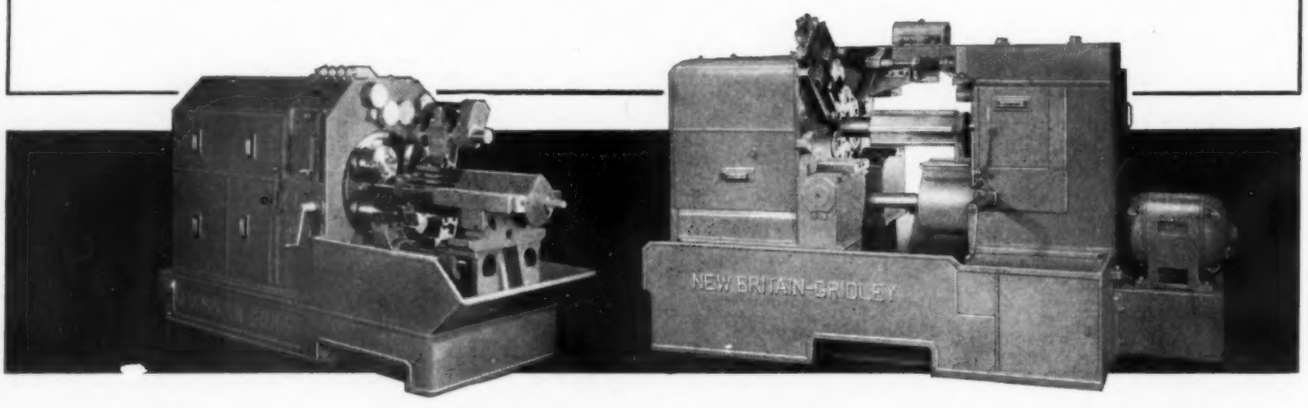
With identifying serial number, our home office can advise as to equipment originally shipped with the machine, and furnish you engineering assistance in adapting it to your work . . . At the same time, we can advise as to cost of any necessary equipment needed to meet your requirements.

Consult our nearest field representative or our home office for further details.



NEW BRITAIN AUTOMATICS

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NEW BRITAIN-GRIDLEY MACHINE DIVISION

B-01036-A

NEWS OF METALWORKING

12,500,000 Tons of Steel Lost So Far; Deliveries Upset, New Orders Held Up

PITTSBURG—Until the steel industry is again able to operate without interruption, no final inventory can be taken of tonnage losses resulting from strikes and their ramifications upon other industries. However, the total loss through May can be set at 12,500,000 tons. The May tonnage loss will exceed 3,000,000, to which may be added another 1,000,000 ton deficit for April, also due to the coal strike. This, coming on top of the 8,500,000-ton loss in the January-February steel strike, has just about wrecked the steel "economy" for the year 1946.

Deliveries Channeled

The price factor has only added to the disruption in steel deliveries. Available steel during the past two months has been channeled to finished products on the basis of (1) essential needs for food, which means tin plate and, then, (2) in relation to profit possibilities. Thus, where there was carbon steel in excess of needs for tin plate, the mills made light flat-rolled products and if anything was left after that, heavier steel items. There was not enough for light-flat-rolled and, as a result, orders even in this material have been pushed much further back.

When labor difficulties recede, a flow of expenditures will descend upon the steel mills as consumers endeavor to find out what they may expect in the way of shipments. It is doubtful if the mills will be able to inform them for some time. The carryovers from the first and second quarter may absorb all the third quarter tonnage which can be made and, importantly, the preference will be given in the production of best-profit items. Consuming industry, therefore, faces a bleak future if it is in acute need of steel items on which the steel mills claim they suffer a loss. Should the mills return to operation in full gear, and the light flat rolled finishing units be unable to absorb all the semifinished steel some of it will "slop over" to other departments.

Industry Changes Likely

The effect of prices may bring about some changes in plant ownership, too. There are a number of rumors about steel companies changing hands. Even some of the non-integrated plants are reported possibilities in this connection. The goal here is to obtain units, for instance, which may be able to produce electrical sheets. This product, in the eyes of the steel industry, has a favorable price structure. Some such plants, also, may be able to obtain individual higher ceiling prices on other types of products and prove to be a profitable operation. They might also permit an integrated producer to increase his deliveries to an important consuming industry—automobiles for instance—which could prove to be a factor in fostering good will for later periods.

New finishing mill installations by the steel industry are being delayed considerably by strikes and parts shortages experienced by suppliers of such mills. Delivery on any new mills placed now would be at least a year.

1947 Orders Refused

Meanwhile, steel consumers are endeavoring to get places on the mill books for 1947. Some producers of steel will not take 1947 orders because of the difficulties of meeting their quotas this year. They are advising customers that if the quota system is continued into 1947, shipments will be made on an equitable basis, depending upon the output of each finished product.

Steel companies, in addition to coal difficulties, are experiencing other raw material shortages, the chief of which is scrap. This trade is dull largely because of the inability to obtain supplies in any quantity. Were there a freer flow of scrap, ingot output could be increased by placing more of this material in the melt.

MOTOR PRICES UP 16½-27%

WASHINGTON—Base prices for motors, a major bottleneck in the equipment manufacturing industries, were lifted by the OPA 16½-27%, effective as of May 13. The 16½% boost applied to integral horsepower electric motors and generators, while the 27% boost applied to fractional horsepower motors. Manufacturers are to notify resellers of their motors of the percentage amount by which they can increase their maximum prices.

Some manufacturers, who had received price relief prior to this order, will not be entitled to these increases.

The boosts will offset higher wages granted by the two major producers, General Electric and Westinghouse. But it is a moot question whether they will justify the expenditure of premium pay for overtime to increase the industry's output to help reduce its enormous backlog.

Senate Debates As Strike Losses Mount—Often called the "graveyard of labor legislation," the Senate finally passed the mild Case Bill under exhortation by the aroused President Truman, but balked at stronger steps. Here, Senators Ellender (D-La.), Lucas (D-Ill.), Knowland (R-Cal.) and Eastland (D-Miss.), in the usual order, confer on strategy to take up strike control legislation aimed at solving the bituminous coal crisis. The only action came from John L. Lewis, who declared a two-week truce, and then resumed the strike

Gaging Business

10% of 1946 Production Lost

It can now be conservatively estimated that at least 10% of our 1946 industrial production has been lost due to strikes or shortages resulting from strikes. Just how much more will be lost depends upon Congress' success with labor legislation which will not only end current stoppages, but head off pending troubles. In any event, it will take from 60-90 days before our industrial economy will be able to recover from the succeeding blows in the form of strikes in automobile plants, in the coal mines, in the steel and electrical equipment industries, and the brief rail strike.

Thus far, strikes have cost the nation the loss of one-seventh of this year's steel production, 10% of its coal production, 15% of its output of electrical motors and controls, and similar percentages of key industrial materials and items, such as copper and brass, bearings, auto parts, castings, and so on ad infinitum covering several hundred strikes.

Yet, more strike troubles loom in the anthracite mines, in shipping, in jurisdictional disputes, and possible renewed flare-ups in various industries (such as the automobile plants) where workers feel they should get higher wages on the heels of higher prices. Such possible acceleration of the inflationary spiral would probably bring renewed strikes in plants.

1947 Plans Pushed

Having literally thrown up its hands at 1946 production schedules, management is now hoping that 1947 will bring some more stable conditions, and is making plans accordingly. This is reflected in the continued strong volume of orders still being placed for new equipment, despite strikes in the plants of the purchasers and regardless of extended delivery dates. Purchasers show much less concern over de'ayed deliveries of new equipment now than they did a few months ago.

This general attitude is reflected in the 15% jump in new machine tool orders placed in April, totaling $32,400,000, as against March's $28,300,000. It was further borne out by low cancellations of $1,400,000 in April. April's shipments, hampered by strikes and parts shortages, only totaled $26,200,000, a slight gain over March's total of $25,400,000. The overall result was a higher backlog of $180,600,000 in unfilled orders at the end of April, up from March's $175,400,000.

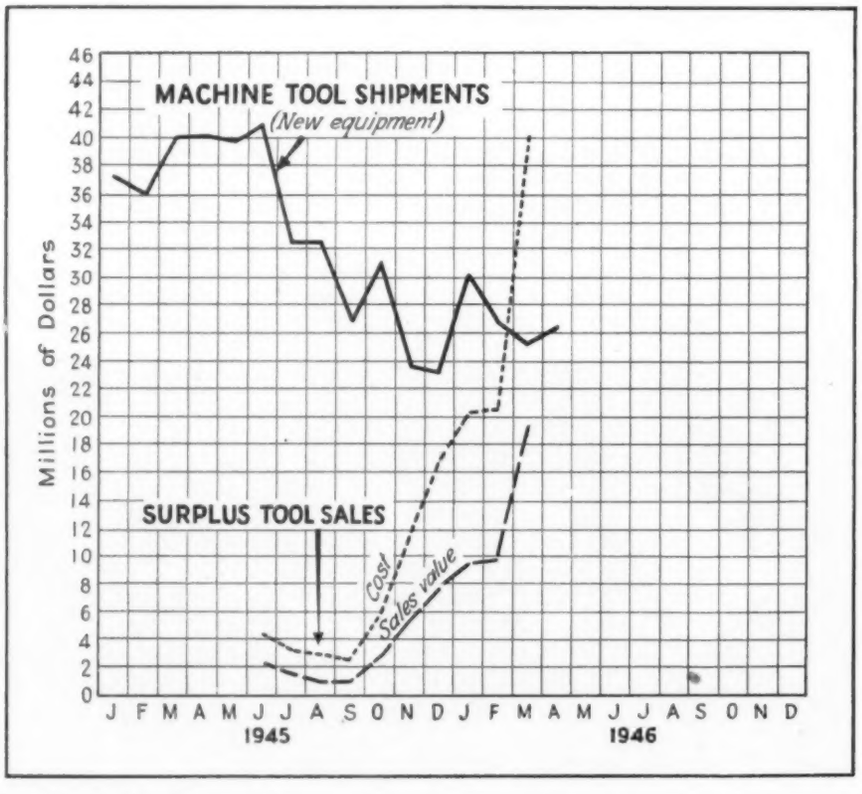
The industry's backlog averages some seven months' business, although deliveries range all the way from a few weeks on drilling machines to many months on shapers, and some 16 months for most presses. A few small types of presses are available within four months. As a result of subcontracting, one press manufacturer has boosted his monthly shipments from $150,000 to $250,000.

Strikes Hit Tool Builders

A new bottleneck in the machine tool industry is the shortage of lubrication systems, as a result of a strike at the plant of a leading manufacturer of these essential parts. This is delaying shipment of otherwise finished tools. Meanwhile, the hope that deliveries of motors and electrical controls would be aided by resumed operations at Westinghouse was dashed by shortage of copper and brass supplies. Various plants producing motors and other electrical items are threatened with shutdowns unless the strikes in the copper mining, processing, and fabricating industries are ended.

Surplus Equipment Developments

Only 118,000 surplus machine tools have been made available thus far of an eventual expected total of 400,000. Large numbers of surplus machines are still held off the market for various reasons. As an example, the Sperry Plant equipment in Brooklyn, which was to have been placed on sale, will be held aside by the War Assets Administration for the present.



Surplus Sales Soaring—Increased declarations of surplus tools and continued difficulties with deliveries of new tools combined to boost the volume of surplus equipment currently being sold by the War Assets Administration. The March volume (at original value) crossed total shipments of new equipment. Surplus machine tools worth $40,061,000 were sold in March for $19,264,000. Shipments of new equipment in that month totaled $25,400,000 and only scored a slight gain to $26,200,000 in April

Lincoln Arc-Welding Contest

CLEVELAND—A $200,000 contest for papers on arc-welding has been announced by the James F. Lincoln Arc Welding Foundation. Closing June 1, 1947, the contest will offer prizes in 15 machinery classifications, each with a $2500 first prize and three smaller prizes, and further subdivided into 43 divisions, each with four awards ranging from $700 to $150. Winners of the classification prizes will be eligible for the three grand prizes of $10,000, $7,500 and $5,000. In addition 217 papers will receive honorable awards of $100 each.

Rail, Coal Strike Force Labor Show-down; Restrictive Legislation Possible

WASHINGTON—Nationwide railroad and coal strikes which threatened to paralyze American industry more completely than any other stoppage this year were decisive factors in forcing a long-expected showdown on the nation's reconversion labor front, one whose labor-management significance still has not been fully assessed.

Public opinion which had withstood the stress of automotive, steel, electrical manufacturing, nonferrous metals, and other strikes without any full mobilization behind demands for rigid labor controls, showed marked change when trains stopped running. Those who had counseled deliberate and slow legislation on labor matters became, in a matter of hours, convinced that fast emergency lawmaking was imperative.

Truman Urges Controls

What happened was best seen in the course of action taken by President Truman, long—and controversially—on public record as an advocate of labor and opposed to restrictive laws which would infringe labor's closely-guarded strike weapon. President Truman, in two dramatic addresses, announced that unless striking railroadmen returned to their jobs he would man trains with army crews, and then followed that up with a proposal that Congress enact legislation which would make strike leaders liable for one-year prison terms and which would permit the drafting of strikers to operate seized properties.

Railroads Run Again

There was no doubt whatever that something had to be done without delay when, on the afternoon of May 23, trains stopped running when 250,000 locomotive engineers and trainmen struck. Food supplies were endangered; a trickle of soft coal moving from mines during a strike truce was cut off; transportation was jammed. The economic consequences of the tieup to industry threatened to be more serious, within 72 hours, than anything yet encountered in the eight-month wave of labor disturbances. Complete paralysis was in the offing when President Truman acted.

As a result of his army strikebreaking threat, and only because of it, brotherhood leaders ordered striking workers back to their trains. Unlike the soft coal mines, the trains could be operated feasibly by army crews, with the probable assistance of nonunion trainmen and of some nonstriking workers worried about seniority and other railroad benefits. In the past, railroad strikes had been broken.

Lewis Unperturbed

Within hours after the trainmen ended their strike, John L. Lewis' United Mine Workers (A.F.L.) ended a two-week truce in the soft coal mines and quit work again. The threats which had worked with the brotherhood leaders fell on deaf ears where the miners were concerned. Years ago, in a similar strike situation, Lewis said characteristically: "You can't mine coal with bayonets." He still considers that true now.

But it was soon apparent that the President's new strike position and his demand for labor legislation would settle the Lewis strike, too.

Few on Capitol Hill had any idea that the Truman legislative proposals would be enacted, despite quick passage in the House by a 303-13 vote. That ballot, taken with an ear-to-the-ground awareness of the public sentiment for some long-range curbing of stoppages in essential industries, could not be duplicated today, or even approximated.

Truman Law Battled

That law would include, in addition to the draft-strikers authority and criminal penalties against employers or union leaders causing a stoppage, provisions for: transfer to the U. S. Treasury of all profits from government operation of a seized industry; injunction rights against union leaders for inciting or abetting a strike in a seized operation; compulsory arbitration to set wage scales in strikes requiring government seizure; and forfeiture of seniority rights by strikers who refuse to heed government back-to-work orders after seizure.

Opposition to such a program came from industry as well as labor. Powers vested in the President were declared to be too sweeping; its effectiveness too slow to prevent strikes; its provision for government seizure of profits too wide a step toward nationalization of industry.

Senate Finally Acts

The slower movement in the Senate gave advocates of the Case bill a new opportunity, and they made the most of it. A flock of amendments to the watered-down version of the measure which already has been passed by the House would: forbid strikes for 60 days to allow for mediation; forbid strikes for 65 days in public utilities and provide for fact finding; remove supervisory employees from any status under the Wagner Act; give employers the right to sue unions for strike damages or for compliance with contracts; ban secondary boycotts or sympathy strikes, and prohibit exclusive union control over health and welfare funds. The Case bill was passed in its greatly altered form, sent to the House committee.

No End To Mass Picketing—Despite the fact that mass picketing is illegal, unions still resort to this tactic wherever they can get away with it, especially in localized strikes. Here, massed pickets keep workers from the strike-bound Pratt & Whitney plant at West Hartford, Conn.

Chicago Plants Resume; Expansion Plans Pushed; Diesel Uses Growing

CHICAGO — Metal working plants here, with the power dimout lifted, are beginning to get back in their stride. The two-week curtailment of output, however, resulted in a 64 per cent drop in production, a 24 per cent cut in employment, and 51 per cent slash in payrolls.

Employees Recalled

Pullman-Standard's Michigan City, Ind., plant, which laid off 70 per cent of its workers when the dimout began, has called back the men, and a single assembly track will be placed in operation. Normally on two assembly lines the plant turns out 54 freight cars a day. International Harvester also recalled 20,000 workers and Electro-Motive division of General Motors took back 7,000 employees. Electro-Motive reported that it has a year's work ahead on the present backlog alone.

At the same time that plant executives are struggling to get output going again, plans for expanded production—when the present period of unrest ends—are continuing to appear.

Electro-Motive has leased a Pullman-Standard plant of 600,000 square feet for the manufacture of subassemblies for the diesel-electric locomotives. The former Continental Ordnance Corp. plant in East Chicago will be occupied by Aerocoach division of General American Transportation Corp. in the fourth quarter of this year. The plant was purchased by G. A. T. C. from the government for $1,400,000, and it is planned to turn out six motor coaches a day with a force of 2,000. The company's present Hegewisch plant, which is much smaller, will be closed when the new plant is occupied.

In another plant deal, Garrett Metals Corp. has offered $3,500,000 for the Chicago plant operated for the government during the war by Revere Copper & Brass Co. If Garrett obtains the plant, it will be used for smelting, refining, rolling and rerolling nonferrous metals.

New Products Announced

Two metal working firms have announced new postwar products. The instrument division of Stewart-Warner Corp. has developed an electric fuel pump suitable for use on passenger cars or trucks and buses, with a higher delivery capacity and smaller size than earlier models which were not adaptable for passenger vehicles. Ingersoll Steel division of Borg-Warner Corp. has designed a low cost model of the company's home utility unit, which is a combination of kitchen, bathroom, laundry and heating equipment prefabricated and ready to be installed in any type of new home.

Harvester Output Lowered

Effects of strikes, material shortages, power dimouts and rail embargoes on the production of International Harvester were outlined by Fowler McCormick as he assumed the post of chairman of the board of the company after a realignment of Harvester's top management. Mr. McCormick estimated that in the year ending Oct. 31 output will be about $150,000,000 less than was anticipated at the start of the fiscal period. The company's plans for a new line of refrigeration equipment are being delayed because of the shortage of sheet steel. Parts from suppliers remain a serious bottleneck, and at any one time there are between 12 and 20 parts tied up by strikes. Harvester's motor truck division faces a shutdown if the parts situation does not ease.

The outlook for the railroads and for their suppliers was examined here by three top men in the field. Champ Carry, president of Pullman-Standard Car Manufacturing Co., said that orders now on the books of car makers total 2,218 streamlined coaches which will cost about $200,000,000, and more orders are expected. When passenger car building stopped in 1942, there were about 2,300 streamlined cars in service which cost $170,000,000. The cars now in service were built over approximately a ten-year period.

H. L. Hamilton, vice president of General Motors, predicted a transition ahead from mixed railroad motive power to exclusive diesel operation. There are now 4,300 diesel units in service with combined total of 4,500,000 horsepower. He also foresees new fuels for diesel locomotives, such as liquefied coals.

And Wayne A. Johnston, president of the Illinois Central Railroad, asserted that "the next five years will witness the greatest transformation in the tools and methods of the railway business that we have ever had in anything like that period of time."

EMERSON USES LIGHT METAL SUBSTITUTE IN MOTORS

ST. LOUIS, MO.—Emerson Electric Manufacturing Co. has substituted light metal parts for gray iron castings in the production of electric fractional horse power motors. The light metals are being used primarily because the castings are in short supply, although a savings in weight has added some value to the switch. Unless the prices of the light metals decline, however, company officials said, castings will be used again when they are available, because the weight saving does not compensate for increased costs.

The company has tooled up for a line of power saws to be manufactured for Sears, Roebuck & Co. Three models—an eight-inch, ten-inch, and another to be announced—will be produced. Orders for $1,000,000 of the saws have been placed by Sears. Emerson is also making a line of arc welders for the retailing organization, and has started production of a fan-type home electric heater to be distributed through its own distributors who now handle Emerson's fans.

GEAR PRICES UP 13%

WASHINGTON—The Office of Price Administration allowed a 13% rise over previous base prices on any gears except gearmotors. Prices for gearmotors were increased on a progressive basis upward of 13% according to a special table in Order No. 637, under RMPR 136. The order was effective May 27th.

Engineering Council to Report On Japanese War Potential

NEW YORK—The National Engineers Committee of the Engineers Joint Council is polishing up a proposed program for the elimination of Japan's industrial war potential similar to the report on the permanent demilitarization of Germany which was accepted by the Allied Control Council in Berlin. Both studies were made at the request of the War and State Departments.

Sixteen working groups of U. S. engineering and technical specialists are cooperating in the preparation of the report, which is due sometime in June. The committee directing the project is headed by Col. Carlton S. Proctor. Serving with him are Dr. Harry S. Rogers, Sidney D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering*; Dr. H. Foster Bain, Dr. R. E. Zimmerman and Charles W. E. Clarke.

Detroit Letter

3rd Quarter Peak Unlikely

Passenger car manufacturers have just about washed out the third quarter as the period when they would recoup the lost production for the first and second. The third quarter had been marked off on their calendars as the time when they could look to attaining the pre-war rate or even better. Now only the final quarter holds any hope.

Instead of improving, conditions have steadily become worse. Plants have gone down and up oftener than Joe Louis's sparring partners. Only the Ford Co. has been consistent. It closed and has stayed closed. It will probably remain that way until it can see much better prospects of obtaining supplies and materials than it sees right now.

The others have been trying to push out some production despite impossible conditions. Their efforts have resulted in some additions to the stocks of new cars but at high costs and unending headaches. If it is not a strike in a suppliers' plant, it is some material shortage that stops the lines.

Many Handicaps Remain

Now the car makers are about at the end of their ropes. Lack of steel, such as spring stock and other hard-to-get specifications, is the current trouble. The coal truce failed to help out one bit and the gradual shutdowns in the steel industry, with production there at the lowest ebb since February, makes it a certain bet that June will be a very poor month for production.

Current opinion is that if the auto plants get into step by July 1, it will be a good omen. Even mid-July would be a good guess for all the plants to reopen, providing the coal and rail strikes are definitely over by then.

Steel and coal are not the only worries either. Copper is in very short supply and strikes in the copper mining areas offer a very definite threat to planning production.

Another worry hanging over the industry is talk of a maritime union tie-up in mid-summer. This would halt the flow of ore down the Great Lakes and create another bottleneck that would be hard to overcome.

UAW May Act Up

The recent price boost given to car manufacturers by OPA is no cause for rejoicing either. The UAW has again asserted its opposition to raises on new cars. It used the price increase factor as one of its talking points in the General Motors strike but modified its stand towards the end.

Now, however, it has been revived and will be made an issue. The idea seems to be to go back for more wages, if the manufacturers obtain further price relief. The latter insist that with all of the boosts okayed by OPA, they still lose money. Their suppliers are not a bit satisfied, either.

So the outlook would be that if all other troubles ceased and the geared-up production lines would start churning out large quantities of automobiles in the third quarter, then the union would again step in and threaten a new tieup. Walter P. Reuther, president of the UAW who led the General Motors strike, stated at the time of the settlement he would be back for more. And he will waste no time.

Labor Forces Disrupted

Despite the long shutdown at Ford's, which idled 110,000, and the on-again-off-again employment in Chrysler and GM plants, widespread unemployment has not yet materialized. True, jobless insurance benefits have soared but the lay-offs have not yet hit business too hard.

The reason apparently is that the skilled auto workers are still in demand in other industries. This may be a factor when the plants reopen. Officials of auto companies fear that production will suffer through lack of these skilled men and efficiency will go down. This, of course, will boost costs of manufacture and result in new demands for auto price increases.

Breech Joins Ford

Idle though the Ford plant may be, top management there still makes news. The latest came with the announcement that Ernest R. Breech, president of Bendix Aviation, would become executive vice-president at the Ford Co., beginning July 1.

This move set the Motor City to speculating. What kind of a deal could Henry Ford II offer to Breech to induce him to make the change? The Bendix president's salary was well into six figures.

Young Ford was silent. Breech smiled and refused to answer a question as to whether the inducement involved the precious Ford stock. The intimation was that it did.

Breech will occupy the spot directly under young Ford. At 49, he is one of the fastest-stepping executives in the industry. He has had a rapid rise from a young accountant to president of Bendix.

In his new post, he is expected to coordinate all the specialists whom young Ford has brought into the fold. He will also have a big part in the planning with which the Ford Co. expects to win back the No. 1 spot in the industry.

Energetic, forceful and fast-thinking, Breech is expected to become a valuable member of the youthful team that youthful Henry Ford II has been rounding up. He made a fine record with General Motors and then with Bendix. His forte has been aviation but he admits that the auto industry is still the most potent factor in America's economy.

Strikes Hit Non-Striking Ford Workers—Although workers at the Ford Motor Co. have not gone on strike in recent months, they have suffered frequent lay-offs as a result of strikes at suppliers' plants. Workers are here shown leaving the Rouge Plant on May 8th, as the company began a gradual shutdown, becoming a complete one by May 18th. The company stated that over 40 strikes in other plants were responsible

Now The V-2 Flies For Us

by
E. J. Tangerman,
Managing Editor

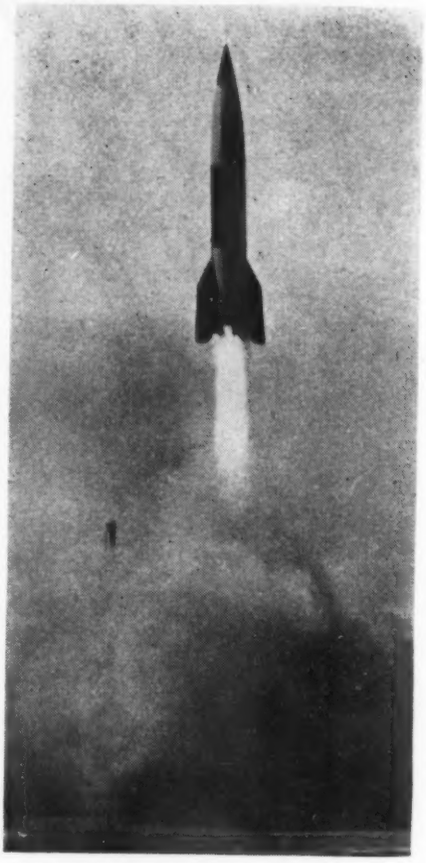
Nazi's vengeance rocket begins tests at White Sands; paired with latest American rocket for Army "world outside" study

WHITE SANDS, N. M.—Time was when a terrifying day for an editor was to visit Aberdeen Proving Ground to watch the firing of a 16-in. gun. Then American military science caught up to—and passed—Buck Rogers with the Bazooka, Super-Bazooka, Mousetrap, Minnie Mouse, Holy Moses, Tiny Tim, Xylophone, Calliope, Grand Slam, Woofus, Whiz Bang, Honeycomb, Snake—all innocent-sounding names for super-lethal rockets and rocket launchers. But the most spectacular rocket of all still is the Nazi V-2, which thus becomes the top ordnance show. It was demonstrated for some 40 newsmen, photographers and movie cameramen—and again as many top military men—at White Sands Proving Ground, N. M., on May 10.

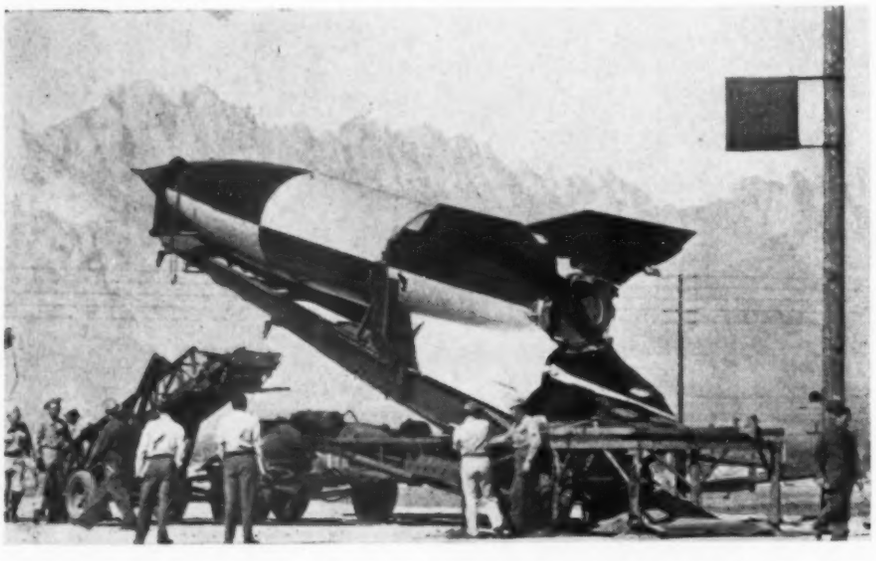
"Vengeance" was the word that gave the German A-4 rocket its propaganda title "V-2." It differs from military predecessors in being liquid-fueled, and in being far larger. Our largest rocket, the WAC Corporal, is a foot in diameter, 16 ft. long, and weighs 700 lb. at launching; the V-2 is 5 ft. in diameter, 46 ft. long and weighs 14 tons.

As a weapon, the V-2 was of no great significance—it was very costly considering its small payload, with limited range and accuracy. But the development of the atomic bomb changes the picture; now development of long-range accurate missiles is of extreme importance. Literally, the sky is the limit, for the Ordnance Dept. is building test equipment for rockets ten times as big as the V-2—a temptation for designers to devise them. Consider for a moment the production from only one German plant—the underground one at Nordhausen—which turned out 900 V-2's per month. With atomic warheads, they'd have been vengeance weapons and no mistake.

It is advisable to explain that a true rocket is a missile propelled by the high-speed rearward expulsion of gases generated by combustion of an internally carried fuel. It operates in obedience to Newton's Third Law of Motion, "For every action, there is an equal and opposite reaction." Reaction from the gases pushing rearward pushes the rocket forward; atmosphere only impedes the rocket by offering resistance. Thus the V-2 is a true rocket; the V-1, or Buzz-bomb, is not because it depends on the atmosphere for oxygen and for support in flight.



V-2 Starts Off—Combustion is started by roman candles which ignite a limited amount of fuel. When the operator is sure operation is proper, full fuel feed is started and the rocket takes off vertically. The 5000 F. jet is 2½ ft. across and about 60 ft. long. Its thrust of 58,000 lb. throws dust, flame and smoke several hundred feet in all directions. Initial acceleration is only 1G, but this rapidly increases to 6G



Raising the V-2 Into Position—The V-2, 5.41 ft. in dia. and 46.05 ft. long, has been carried to the launching site on the *Meiller Wagen*, a special trailer which also acts as a working platform. The rocket is set vertically on a rotatable ring mounted on adjustable legs. This permits leveling and "aiming" by setting the gyro-controlled fins with relation to the target

The V-2 was no sudden development; it took twelve years by the best available German scientists and millions of dollars. We are now capitalizing on this work to obtain fundamental information which will help us develop better, longer-range missiles. To speed the job, we brought over here parts for some 25 V-2s and placed in "protective custody" a number of German scientists connected with guided-missile research for over ten years at Peenemunde.

To assemble the V-2's, replace missing parts, repair damaged one and provide fuels, General Electric has been employed. This permits a variety of additional test objectives,

including testing of alternate components, use of radar in tracking and in countermeasures, developing of instrumentation and studying of trajectories, upper-atmosphere physics and the like.

To accomplish these objectives, the "warhead" of the V-2, with its explosive filling, becomes a "peacehead" filled with scientific paraphernalia for exploring the upper atmosphere and for evaluating the performance of the propulsive system and automatic controls of the rocket. The fuel supply used by the Nazis to fire rockets into London from launching areas more than 200 miles away on the continent, over a trajectory reaching a height of 60 miles, can, when the automatic controls are set properly, send them up to twice that height in a very nearly vertical trajectory ending in a safe impact area within the Proving Ground.

100 Miles Up

In the current firings, the height attained will be about 100 miles. The V-2 launched May 9 went 72 mi. (127,000 yd.) high and landed 39 mi. from the firing point. Fuel remaining when burning was terminated by remote control exploded on impact, gouging out a hole 20 ft. deep and 30 ft. across and burying its head in hard clay and gypsum sand. (Actually, the 10 tons of fuel in a V-2 has more energy content than its 1800-lb. warhead by many times—even the remainder frequently matches the warhead in power.) Lateral error was only 340 yds., or about half of one percent.

The V-2 is propelled by reaction or recoil from expulsion at high velocity of a jet of gases produced by alcohol and liquid oxygen burning at high pressure in a carefully designed combustion chamber with a suitable venturi nozzle. As fired against London, about 14,000 lb. of gas expelled at an average velocity of 6800 fps. gave about 10,000 lb. of rocket and unburned propellants a forward velocity of 4900 fps. when the fuel supply was cut off and burning ceased. This happened about 60 sec. after take-off when the rocket had travelled 25 mi. along its trajectory and was moving in a direction 47 deg. away from the vertical, i.e., 43 deg. above the horizontal, at a point 17.5 mi. above the ground and 15.5 mi. longitudinally from the launcher.

The normal trajectory gave a start at the fourth second, fuel cut-off at 67 sec. and 3,440 mph., 22 mi. from the launcher and 24 mi. in the air. Maximum elevation of 50.8 mi. at 176 sec. and 147 mi. and impact at 306 sec. and 182 mi. This takes the V-2 through the troposphere (to 40,000 ft.), the stratosphere (40,000 to 270,000 ft.) and into the Heavyside layer (270,000 to 320,000 ft.) The May 10 shot went beyond into the ionosphere, establishing an American record of 360,000 ft.

During the burning period, the direction of the rocket is controlled by the action of four movable vanes on the fins in the tail assembly and four graphite ones in the jet—the latter essential during the low-velocity starting period when the fin vanes have no aerodynamic effect. Vanes 1 and 3 in both groups are in tandem to control roll and yaw. Vanes 2 and 4 in the jet path control pitch, while fin vanes 2 and 4 act as stabilizers. The 1 and 3 vanes and stabilizers 2 and 4 (independently motored) are controlled by a gyroscope to maintain the axis of the rocket in the vertical plane through the launcing and target points, thus making the rocket go in the right direction. Jet vanes 2 and 4 are controlled by another gyroscope to produce and maintain correct inclination of the trajectory during the burning period. This second gyroscope is subject to the control of a third gyroscopic system, the real brains of the missile, which serves to maintain vertical travel to a height of about one mile, then to tilt the rocket slowly away from the vertical until it travels on the desired course, thereafter to maintain this course until the velocity is correct for the range desired, and finally, to cut off the fuel supply at that velocity, thus ending propulsion. Fuel cut-off can also be accomplished by remote control from the ground. After jet propulsion has ceased, the rocket behaves like a projectile fired with the same speed and direction from a gun.

The rocket rises vertically, at first, and slowly, but travels ever faster (max. acceleration 6G) until about a minute later it reaches the cut-off value over 3000 mph.—nearly five times the velocity of sound. The jet flame which helped to keep it in sight ceases and it is lost to view. It is

In Position For Launching—Without fuel, the rocket weighs 5 tons, of which two tons is warhead. Five tons of alcohol and four tons of liquid oxygen fuel it. These are pumped to the combustion chamber by the turbopump driven by steam resulting from breakdown of hydrogen peroxide with a catalyst. The cables power the three control gyros until just before launching

Fuel-caused Crater Is Small—The first rocket tested broke a fin in launching, so fuel was promptly cut off. It went out about 19 mi. and dug this 20x30-ft. hole in the hard gypsum-sand of the desert proving ground. The rocket carried no warhead—this crater was made by explosion of fuels alone

terrifying to watch even from 1000 ft. distance, because it soon appears to be directly overhead, and air currents disarrange the smoke generated at fuel cut-offs. You assume flight is erratic.

The V-2 has, in order, these major elements: nose or warhead, control compartment, fuel tanks, turbine and pumps and venturi. Fuel tanks occupy almost half the total length—20.2 ft. Tanks are cylindrical, with domed ends. The upper (alcohol) tank tapers slightly toward the nose, weighing 255 lb. with fittings. The oxygen tank weighs 375 lb. with fittings. Both are aluminum alloy of graduated thickness so they can carry the fuel weight only when the rocket is vertical. Further, atmospheric pressure would collapse them if pressure were not maintained as fuel is used up. They are insulated from the shell by heavy layers of glass wool which helps rapid establishment of thermal equilibrium between oxygen tank and oxygen during filling.

The power bay, 12.4 ft. long, has the lower 6 ft. occupied by the "engine," really a combustion chamber and venturi. In the chamber head are 18 inlet spray cups. Chamber walls are double, the alcohol entering between the walls at the venturi lip and cooling walls as it flows up to cup nozzles. The entire assembly is of low-carbon steel comparable to SAE 1,020. Total weight is 1,025 lb., which is increased to 1,975 lb. by accessories, valves and feed lines. Maximum internal diameter of the combustion chamber is 37.3 in., of the nozzle 15.7 in. at throat and 29.2 in. at mouth. Average chamber pressure in operation is 220 psia., final expansion of the jet is a bit under one atmosphere. Combustion temperatures are over 2,650 C., but walls are held to about 1,000 C. by the alcohol cooling. Oxygen-alcohol consumption is about 276 lb. per sec., developing 58,000 lb. thrust at sea level and a top of 64,000 lb. when reduced atmospheric pressure and higher acceleration of fluids increases power.

A point of interest is the fact that the control system is entirely self-contained and reacts automatically to a preset program to maintain the trajectory. After the rocket leaves the ground, the only control possible is to shut off fuel by radio. (This control was used when the first rocket was launched at White Sands; one fin broke off shortly after launching.)

Seventeen triangulated checking stations are used in tracking the V-2. Four different tracking methods were used May 10: radar, optical, photo, and sonic (Doppler). The radar methods involve radar impulses from a unit in the nose and reflections from three tail surfaces. Both optical and photo (the latter for record) are achieved with an ingenious German instrument, the Askino theodolite, set up 8 to 10 mi. from the launching site. The unit has a tremendous lens, which enables two operators to watch the V-2 150 mi. *visually*. A built-in camera records the action at 60 frames per sec. Three of these instruments at widely separated points permit checking of roll of the projectile by showing the special pattern painted on it.

Newly developed radio beacons, which contain their own power supply and are actually miniature radio receiver-transmitters, have been fitted into the V-2 "peacehead" for one tracking device. Antenna are in plastic housings on fins. During flight, the receiver is triggered from a ground radar set by pulses which cause the transmitter to repeat the pulses to the radar. This permits the trajectory to be recorded photographically. The Signal Corps radar set used is modified from a unit developed during the war for detecting hostile aircraft and directing anti-aircraft guns.

Conventional radar equipment also tracks the V-2 for its entire flight without the aid of beacons. As the V-2, as fired on London, contained no electronics guiding equipment, emissions of which might be tracked, this method simulates detection of rockets fired by an enemy.

WAC Corporal

Many types of rockets, most of them of the solid-fuel type, have been developed by Calif. Institute of Technology in a program sponsored by the Ordnance Dept. The exception is the "WAC Corporal," a liquid-propellant rocket.

The WAC, an all-American design, differs from the V-2 in that it has no control system except for three stabilizing fins. Hence its action is somewhat unpredictable. It is launched vertically from a triangular 100-ft. launching tower, and thereafter goes its own merry way, affected by wind, earth rotation and its own pecularities. These characteristics suggest some of the reasons for the female appellation of "WAC," the "Corporal" coming from the fact that some Army rocket projects are designated by familiar ranks. Suffice it to say, officers in charge of the May 10 test (all married men by the way) were so uncertain of its actions that they kept all observers at the very respectful distance of six miles! Indications were that it—or the two principal parts into which it breaks when its fuel tanks collapse as it reenters the atmosphere, fell into the desert five miles the other way, but it appeared to be right over our shrinking scalp when it vanished on its way up.

The WAC also differs from the V-2 in having different chemicals to power

pumps which feed propellants to the combustion chamber and in being "boosted" during its first few seconds of flight by a powerful, short-duration solid-fuel step rocket. This brings the WAC to supersonic speed in 0.6 sec., then falls away to let the WAC motor carry on alone. Judging by its actions and by the appellation "Tiny Tim" which officers let slip, this step rocket is a variant of the giant rocket which made a fighter plane able to hurl at an enemy target more high explosive than is carried in a salvo from a light cruiser. Tiny Tim was the first multiple-grain American rocket, having four dry-extruded ballistite grains, each weighing some 40 lb. Its original war head was 150 lb. of TNT.

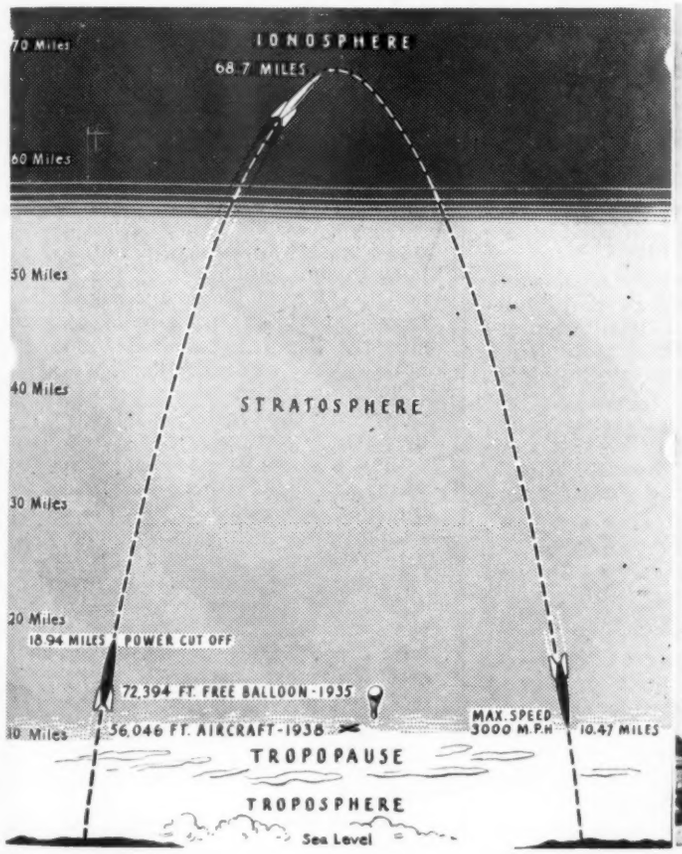
Presumably, the launching tower could be tilted slightly to "aim" the WAC and payload limitations are sufficiently large to carry an atomic warhead, but primary present development is to make the WAC a vehicle to carry meteorological instruments into the stratosphere. In tests at White Sands last October, the WAC reached an altitude of 230,000 ft., or 43.5 mi. This elevation was assumed attained in the May 10 test, although radar tracking failed at 55,000 ft. because the rocket was too small to track further by radar.

The WAC costs about $50,000 to make in this country. This could undoubtedly be cut considerably in mass production, but the WAC will probably be discarded in favor of models now under development. The WAC Sergeant (to anticipate a name as well as to conjecture about characteristics) will probably be thinner-shelled and generally lighter in details, hence able to match the V-2 in altitude and may also carry a higher payload.

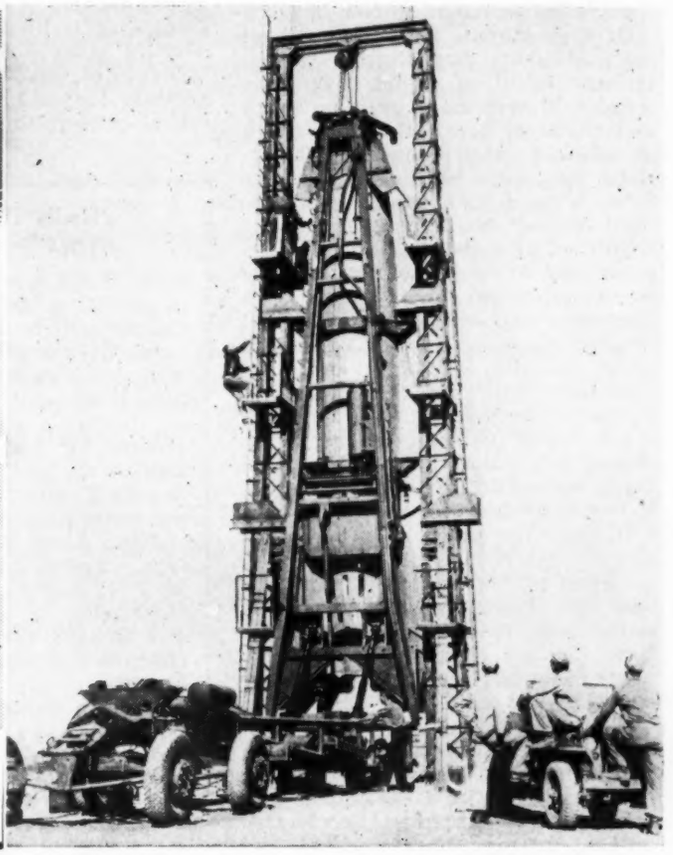
Both the V-2 and the WAC will be used to carry instruments into the upper atmosphere in future tests. These will measure temperatures, densities and pressures, make spectographic records, count cosmic rays, take samples of gases, dust and bacteria (if they reach such heights). Still other measurements are being suggested by scientists from all over the country, indicating that some will be disappointed or more and bigger rockets will be required. Officers conducting the tests also want to make some measurements of their own. Skin temperatures, action of control vanes on the V-2 and their effect where there is no atmosphere for them to act upon are among them. It is known, for example, that the V-2 does not fall with its axis parallel to its trajectory, until it reenters the atmosphere. For some period after its propulsive power is expended and the earth's gravitational pull begins to pull it back, the V-2 remains in its final uptilted position. Control gyros may activate vanes, but nothing can happen until the vanes have some air against which to push. Then aerodynamic surfaces again become effective.

Skin temperature is estimated to rise to about 600 C. (1300 F.) when atmospheric friction decelerates it from its top speed of 3500 mph. to 2600 mph. before its strikes. Enough of this heat is transmitted to the control chamber that plywood dividers there are scorched. This is of course a problem in instrumentation as well. Scientists have three choices:

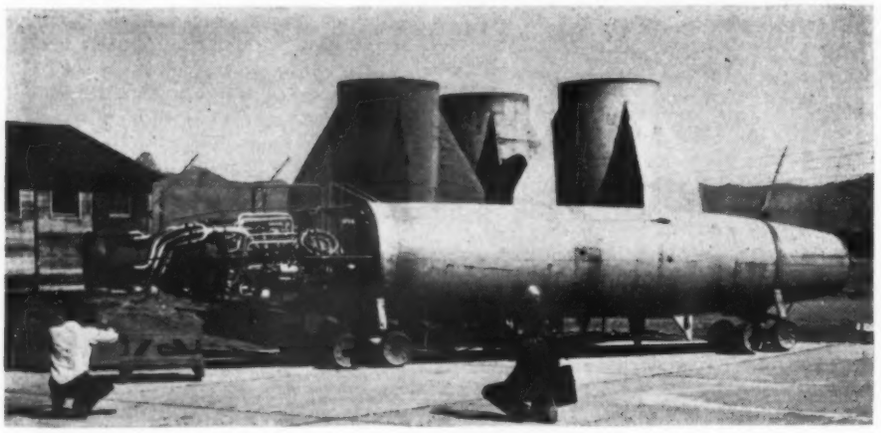
1. To produce instruments which can stand the shock of striking the earth, the heat of deceleration, and



Typical Trajectory Calculation—This is a typical trajectory of a variety calculated by General Electric with the new electrical integrator. The maximum height is expected to be 150 mi., or the trajectory can be flattened for a range of 225 mi.



Test Tower for Rocket Motors—This tower, built in the side of a cliff, is used for static test of rocket motors, one of which is shown being mounted into position for testing. Jet gases, cooled by steam, are deflected through the concrete base out into the desert



V-2 Tamed—Here three tail-fin assemblies stand behind the rocket with its tail exposed and without its nose sting. The venturi, combustion chamber and turbopump are in the rear section of the rocket, under the four tail fins. Controls are between the fuel tanks and the warhead

possible explosion of remaining fuels.

2. To use instruments that broadcast to ground recording devices.

3. To devise instrument carriers that will throw them out after desired records are obtained, then parachute them safely to earth.

Of these three, the third appears most advisable, but presents several serious difficulties. What cover material will withstand ejection shock and frictional heat? How can speed be reduced safely, when a conventional parachute will not open where there is no air and would promptly burn anyhow when air friction is encountered at supersonic speed? The parachute could be forced open by an inflatable rim tube operated by a compressed-air bottle, but the heat problem remains. One solution might be to eject the instrument container backward with sufficient force to counteract enough of the rocket's forward speed so skin temperatures stayed low. Another is to use metal vanes instead of a 'chute; still another is to use a rocket brake.

Incidentally, there have been frequent press reports of offers by individuals to ride within a V-2 at their own risk. These are true—I read one letter from a sane and responsible New England man of some prominence, who has developed a pressure suit. The V-2 could readily carry him, and the 6G maximum acceleration never approaches the 8 or 9G at which men "black out," so getting him up there would be simple. But how can he be ejected and decelerated without burning to a cinder? And if he stays within the rocket until close above the earth, how can he endure the inside temperature?

Meanwhile, the V-2 provides 20 channels for sending back radio and radar records of its flight. These will be used to examine to the greatest possible extent the outer reaches of the earth's envelope, where cosmic rays and shooting stars abound, beyond the fringes of the atmosphere which acts as a filter for such visitors from interstellar space. Our present knowledge is limited to distances of only 19 miles above the earth—the V-2 and the WAC-to-be may make it possible for us to reach out to 150 miles—or eight times as far.

SWAIN TO REPORT ATOM BOMB TEST

NEW YORK—*American Machinist* and other McGraw-Hill Publications will be officially represented at the Bikini atom bomb test this summer by Philip W. Swain, editor of Power. Besides an extensive engineering background, Mr. Swain has been active on the McGraw-Hill Atomic Energy Committee since its formation in August, 1945.

Joint Army-Navy Task Force One, headed by Vice Admiral W. P. H. Blandy, is directing this "Operation Crossroads," which will involve the services of 35,000 men and 100-odd target ships. The ships, only three or four of which are expected to sink, will be grouped in a carefully planned pattern at the west end of the huge Bikini Atoll (approximately 25 miles x 15 miles).

Two bombs are to be exploded this year. Early in July, bomb No. 1 will be dropped from a high plane to explode in the air. Bomb No. 2 will be set off at or near the water surface late in July or early in August.

Canadian Freight Rates to Rise; Labor Restive, Strikes Looming

OTTAWA — Confronted with rising labor and material costs and declining revenues Canadian railways are following the example of American lines and applying for freight rate increases.

The two companies, the privately-owned Canadian Pacific, and the government-owned Canadian National are now working on an application to the board of transport commissioners for an increase to a level which has not yet been stated. The application of the American lines to the I.C.C. for a 25% increase is approximately in line with what the Canadian lines want but for them the position is complicated by long-standing claims for adjustment in the freight rate structure.

If they apply for a flat increase on all rates they will have to face demands for reduction on rates which are alleged to be discriminatory against certain areas, notably British Columbia. The actual move for higher rates was deferred until now at the instance of the government which was attempting to keep the lid on prices and wages. The go-ahead signal to the railways came at a time when other indications of a bolder policy in price decontrol, which in fact means progress to higher levels, appeared.

In Eastern Canada, there were indications that with industrial layoffs threatened because of the coal shortage some unions were hesitating to move briskly towards walkouts. Sudbury miners, employed by the International Nickel Company asked the labor department to appoint a conciliator. The International Union of Mine, Mill and Smelter Workers (CIO) to which they belong had previously announced its intention of by-passing government channels and calling a strike if its wage demands were not met without reference to the War Labor Board.

Other pressures in the labor picture arise out of demands by:

United Steelworkers of America (CIO) for a minimum wage of 84 cents an hour and a 40-hour week with proportionate pay for skilled and semi-skilled workers;

United Rubber Workers of America (CIO) for a general wage increase of 20 cents an hour and a 40 hour week with a strike call already issued.

United Electrical, Radio & Mechanical Workers of America (CIO) for a general increase of 25 cents an hour and the 40-hour week; Canadian Seamen's Union (AFL) for a three-watch system, 56 hours a week, without reduction in pay with a strike deadline tentatively set for June 7.

Shortages Hit Southern Plants; Equipment Orders Expanding

ATLANTA—Shortages in many basic materials and metals, due to the coal strike, are tightening the markets for finished products. Manufacturing plants see no early relief and are tinkering with substitutes. The effect of the steel strike is still keenly felt and manufacturers see loss of business as shifts are made to substitutes.

Small machine and metal working shops have been hard hit in many instances and have been forced to reduce production schedules until stocks are again available. The backlog of orders continues to pile up with many plants booked ahead for a year or more. Additional manufacturing space is hard to obtain which has slowed down expansion plans.

Many new businesses have started up since the first of the year and the number of inquiries show a steady increase. Some of the important new manufacturing plants started in past month include Van Bergen & Greener, Inc., automobile parts and repairs; Kinsey Electric Products Corp., fluorescent and neon light transformers; Atlantic Separator Co., battery separators; Henry & Hutchinson, Inc., tooling and speed machinery; Atlanta Machine Works, Inc., Atlanta Plastic Products Co., Ashby Associates, toys.

Materials, Labor Short

Lead is very scarce in this area as is true of brass. Shortage of coal and coke has depleted steel stocks. Scrap is being held in dealers' yards hoping for higher prices. Orders for machine parts are higher but delivery is slow. There is a great demand for bars and strip but little is available to the trade.

Labor conditions have improved of late but the labor demand is greater than the supply ready to go on the job. The government's unemployment program of $20 a week is keeping many GIs off available jobs. Another factor making for a tight labor market is the large number of GIs returning to school. Big problem the schools see now is "where will we put them" next fall.

New Equipment Ordered

Atlantic Coast Line Railroad and Florida East Coast have ordered many new passenger train cars for use in the New York - Florida service. Georgia Power Co. has ordered a string of new trolley coaches and motor buses.

Construction of several large manufacturing plants is being held up awaiting steel trusses and girders. The Pomona Products Co. is installing new equipment and a continuous production line in the addition to its plant which has only the floor and roof. There has been no assurance when brick and other materials will be delivered to complete the structure. Lumber is being collected at the new Ford plant but there are no indications when steel and other materials will be delivered.

CIO-AFL Union Drive

Big problem facing Southern industry now is the CIO and AFL union membership drives. The two unions are competing with each other for members and both are handing out ballyhoo to "sell the South to Southerners" — the windup to board the labor union special to the promised land. Southern labor has never been union minded and the big test will come when the drives get under way.

Falter Works on New Turbine

BUFFALO—Additional space required for research on a gas turbine engine of radical design for aircraft jet propulsion and other uses has caused Frederic Falter, Inc., to lease a four-story factory in North Tonawanda, N. Y. Without revealing details of the new turbine, President Frederic Falter predicted it would increase the cruising speed of conventional aircraft by 80 miles an hour. He said that its use in transports would reduce passenger airline fares from four-and-one-half cents to three cents a passenger mile. Organized in 1944, the firm is staffed by engineers formerly with Bell Aircraft Corp. and Curtiss-Wright Corp.

FOREIGN REPORTS

(This news is supplied by staff correspondents of the McGraw-Hill World News Service)

London—Producers of finished iron and steel products fear an increasingly tight labor supply as a result of the cancellation of the labor-draft May 15. Manpower shortages already have slowed output of foundry items for construction, textile and other machinery.

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BUENOS AIRES—The Argentine State Railways have placed a $1,000,000 order with Fielding & Platt, Ltd., Gloucester, England, for construction of a railway wheel and axle plant.

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SAO PAULO, Brazil—A new steel mill with an annual production capacity of 54,000 metric tons is to be built in Minas Gerais, 60 miles from the Itabira iron ore deposits. About $74,700,000 will be spent in the U. S. for construction materials and fabricating equipment.

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HELSINKI, Finland—Construction of two new plants at Vaasa makes Strombery Oy. one of the largest electrical apparatus manufacturers in Northern Europe. Present output would satisfy most of Finland's needs were it not for reparations to Russia which include some 600,000 electric motors.

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SANTIAGO, Chile—The Pacific Steel Corp. has been organized to build the projected steel mill at San Vincente Bay, near Concepcion. Final capitalization will total $53,000,000. The mill is expected to be in production in about two years and is scheduled to produce 500 tons of pig iron daily in its initial stage. The Chilean Development Corp.'s New York Office now is purchasing equipment and hiring engineering and technical workers.

Dow Reopens Magnesium Plant, as MRC Freezes Stock; WAA Eyes Surplus Plants

WASHINGTON — Dow Chemical Company's Freeport (Tex.) seawater magnesium plant, closed since the war's end, will be reopened and production will reach capacity "by midsummer." At present no magnesium plant in the country is in production; fabricators are supplied from war-reserve stocks.

Company's decision on the Texas plant was held up for a time pending formation of government policy on surplus magnesium, on magnesium plants, and on magnesium fabricating plants. There still is no set policy on plants—only recommendations, but Metals Reserve Corporation has frozen its magnesium stockpile. That is no guarantee against future release on the market but, coupled with magnesium's intriguing future, it encouraged Dow to take the plunge and continue as a pioneer in the field.

Operations Consolidated

Company's magnesium operations are now consolidated under a separate executive board and general manager, bringing sales, fabrication and technical divisions under Dr. J. D. Hanawalt, former director of metallurgical research. The new setup throws the full weight of Dow's technical know-how behind the sales department, whose opportunity rests in switching consumers to magnesium in a wide range of transportation equipment and hand-held devices.

The government owns 90% of magnesium producing capacity in 13 plants which cost $370,000,000, but it owns less than half of fabricating capacity. Present high cost of finished magnesium goods is not in production of the metal, but in the difficulties of fabrication, which will have to be improved.

Yearly Capacity 293,000 Tons

Present total U. S. capacity is 293,000 tons per year, of which 30,000 tons are privately-owned by two companies: Dow and Permanente Metals Corp. A rough guess is that 130,000 annual tons would be needed in another war. Thus, present private capacity, plus about 100,000 tons of retained government-owned capacity, could meet an emergency, and the balance, or some 163,000 tons capacity could be disposed of, and converted to other uses.

These estimates, contained in a report on magnesium plants and facilities by War Assets Administration, place prewar peak consumption at only 3350 tons per year, and consumption in the next five years at not more than 33,000 tons per year. Thus this peacetime capacity would nowhere near meet military needs for a long time to come.

War Assets' proposed answer to this problem is aggressive government-sponsored technical and promotion programs to encourage "operators other than Dow" to take over government plants and to insure at least their partial operation, rather than maintain government plants in standby. So far, WAA hasn't got a nibble for its magnesium plants, and Dow, regardless of government activity, will be kingpin in the business for some time.

Surplus May Be Increased

Present surplus stockpile is about 25,000 tons, which may be augmented by another 25,000 tons from contract terminations. So long as this total of 50,000 tons in stockpile remains frozen, it can be disregarded in production calculations.

WAA recommends that the following plants be retained in operation: Freeport, Texas (an extension of Dow's private plant there); Velasco, Texas; Spokane, Washington; Canaan, Conn.; and Painesville and Luckey, Ohio. Four other plants should be sold or leased under agreement that their ability to produce magnesium will not be impaired. It is assumed the Dow plants at Freeport, and at Midland, Michigan, and the Permanente plant, at Los Altos, Calif., would remain in operation. WAA's report does not cover fabricating plants.

Dow Commended by WAA

In general, plants having the lowest production cost records, ranging around 12c to 20c per pound, have been selected for maintenance in operation. Costs of other plants ranged between 25c and 73c per pound. Dow, by reason of its long experience, is commended by WAA for its efficiency in producing at 12c.

Chief obstacle to magnesium use is cost. Here are some comparative prices for metal sheet: pure magnesium, 70c; strong magnesium alloy, 80.5c; pure aluminum, 24.1c; strong aluminum alloy, 30.7c; copper, 20.8c; stainless steel (18/8 alloy), 34c; carbon steel, 3.05c (cold rolled).

Future price of magnesium will be about 14c to 15c, which is not bad, comparatively. But the fabrication spread, due to chemical activity, fire hazard, quick cooling, high shrink and melt losses, is high. Because of modified peacetime requirements, fabrication costs will come down, but so will they on other metals. Technical improvements will help most to even the score. Magnesium metalworking is practically an unknown field. One official said he had not been able to find a single book on the subject. A favorable characteristic of magnesium is that it is easy to machine.

Opportunities for magnesium at the right price, are interesting in airplanes, cars, rail cars, trucks, handheld tools and other portable machinery, reciprocating parts to reduce vibration, high speed rotors to reduce centrifugal loads, conveyors, office equipment, typewriters, lawnmowers, bicycles, foundry flasks, knitting and weaving machinery, patterns,—the list is nearly endless.

118,000 TOOLS SURPLUS; DETROIT HAS $158,000,000

WASHINGTON—At the end of March 24th, the War Assets Administration had 118,000 surplus machine tools on hand, valued at $509,708,000. Up to that date, WAA had sold 47,541 machine tools, valued at $165,314,000, for $88,727,000.

Of the March 24th inventory, 31% consisted of lathes, 19% of grinding machines, 18% milling machines, 10% boring machines, 10% drilling machines, 6% gear-cutting machines, and 6% of other types. The largest surplus tool inventory, valued at $158,000,000, was at Detroit. The second largest stock, $85,000,000, was at Chicago, with Cleveland next with $73,000,000 and New York fourth with $70,000,000.

Up to March 24th, 1,693 dealers had been approved as agents for surplus equipment.

Resistance Welding Contest

PHILADELPHIA — Prizes totalling $2,000 for original papers on resistance welding are being offered by the Resistance Welders Manufacturers Association in a contest which closes next July 31. First prize of $750 and two smaller prizes will be awarded for papers from non-university sources, and two other prizes are reserved for university applicants. Papers may cover almost any improvement of products or techniques for resistance welding. Minimum length is 2500 words, and entries should be sent to the American Welding Society, which will appoint judges for the contest.

Washington Bulletin

Surplus Rebuilding, Trade-ins

Rebuilding of surplus machine tools, for resale under new-condition guarantee, but at a lower price, is about to be authorized by WAA, after long consideration. This will permit WAA to dispose of tools which otherwise could not be moved, and it will enable purchasers of limited means to get better equipment for their money. The order, at this writing, did not prohibit exports. Control of exports, to protect reputation of the manufacturer, was thought desirable, but could not be accomplished through WAA regulations. It was hoped that State Department could assume the responsibility. The order was being amended to open the program to authorized rebuilders within the United States. "As is, where is," was to be changed to "As is, f.o.b. cars."

An order authorizing purchasers of surplus machines to trade in their old ones on the deal was in preparation by WAA. It was expected there would be considerable criticism of its terms when the draft is circulated. Trade-ins undoubtedly would help to move newer machines into industry and speed conversion by raising efficiency. At the same time, if any substantial allowance were made on the trade-ins, the purchaser turning in worthless equipment as part of the purchase price would have a competitive advange over a purchaser paying all cash. Furthermore, while WAA would be disposing of surplus stocks, it would be gaining others even less disposable.

Equipment for Institutions

War Assets Administration is about ready to issue an order on donation of surplus machine tools to educational institutions. At first the plan was to donate mostly unsalable machines, but the order will authorize giving any equipment in long supply, if it is not needed to boost conversion and employment. Qualified, nontaxpaying schools will make application through the Federal Security Administration or direct to WAA. Under a law passed before the surplus property act, the Army is authorized to donate machines, and has been doing so. WAA may ask the Army to relinquish this right, so that donations may all be cleared through one office.

Surplus Magnesium Plants

WAA's report and recommendations on magnesium plants is one of the best to come out of a Washington agency for some time. It is an education in a few easy lessons for metal working men who wish to get abreast of this new field, which has attractive potentialities. Production of the metal is not new: it strung along for years before the war, which gave it new impetus. But the technology of fabrication is wide open to development, most of the existing knowledge now being in the brains of Dow Chemical engineers.

Though WAA's report is highly praised, it is also criticised on two points: it seems to recommend expansion at the expense of Dow, which did nearly all the pioneering, and it bases the need for this expansion on the need for future military production, while the author admits that magnesium may not be essential to the next war. His answer on the latter point would be, of course, that the United States cannot afford to gamble on anybody's judgment as to metallurgical requirements in future conflict.

"Retooling America" is the title of a booklet issued by the War Assets Administration. It's a quick reader on the advantage of buying surplus machines, and how to do it.

Higher Prices on Capital Goods

OPA's second in a planned series of five capital goods price suspension or de-control orders is due about now. In fact the order is over-due. OPA delayed it on the ground the coal strike caused unexpected loss of production, which has augmented the tendency to inflation—for lack of goods to soak up excess cash. The second order is expected to lift price control from an additional category of machine tools.

Importing Italian Motors?

Italy wants to sell electrical goods, including small motors, light equipment, parts and appliances to the United States. This limited source of much-needed items was revealed a few days ago when a representative of the electrical goods industry in Italy arrived in this country and called at the Washington office of *American Machinist* for assistance in locating import price officials at OPA. He said that Italy has a large quantity of small motors, some in 120 and 240 voltages and some in cycles suitable for use here. The industry in Italy, he said, is in a position to produce quickly large numbers of motors and other goods to specification. OPA import-export price officials said there would be no ceiling and no markup on the Italian goods if sold to users—manufacturers would be regarded as users. They were hopeful that the current shortage could be alleviated partly by such imports.

Captured German Documents

Ten tons of documents taken from the German Patent Office are now being sorted and evaluated and will eventually be disseminated for the benefit of American science and industry, Casper W. Ooms, Commissioner of Patents, announced. Seized by the United States Army in Germany, the documents were shipped to Wright Field in 146 packing cases. Army authorities then turned them over to the Office of the Publication Board, Department of Commerce, for dissemination to the public through its facilities. The United States Patent Office and OPB are cooperating in sorting and evaluating them.

Big Brazilian Steel Plant—The new Volta Redonda steel plant, now in operation will help the industrialization of Brazil and enlarge this market for American industrial equipment. Open-hearth furnaces with smoke stacks are shown in the background, while the uptake of a blast furnace top is shown in the foreground. The plant was built by U. S. firms

Spotting the Air News

Guided Missile Tussle

Army Air Forces and Army Ordnance are in the initial stages of a tussle forc ontrol of guided missiles. Ordnance had the upper hand the other day at White Sands, New Mexico, when it conducted tests of German and American V projectiles, rocket powered.

This intra-mural Service battle, in years to come, could surpass the present struggle, in proportion and intrigue, over unification of land, sea and air forces. But it would be different. Whereas the present fight is mostly land and air against Navy traditionalism, ordnance and air forces would be contesting control of a futuristic weapon that could possibly put most present ones on the scrap heap.

Military Aviation Obsolete?

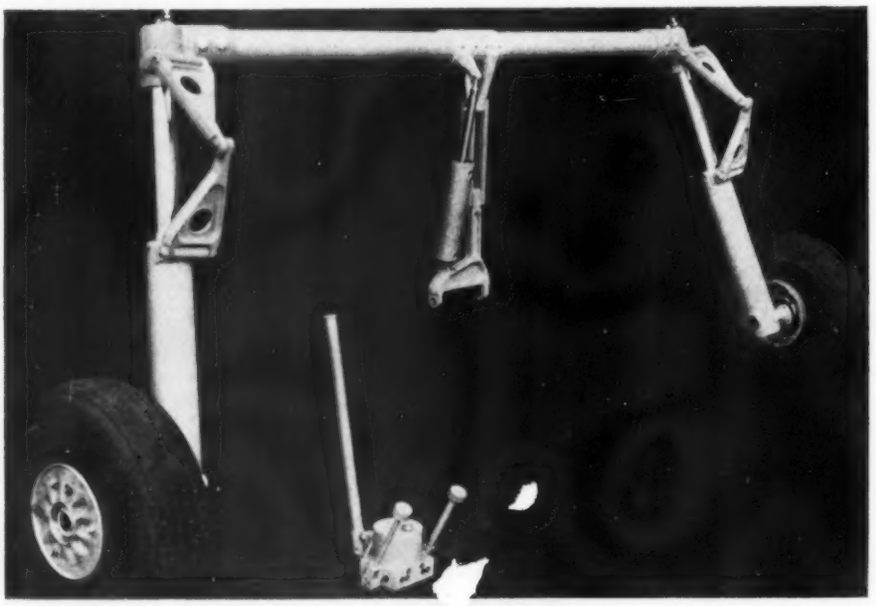
Military aviation itself could be made obsolete. If expected range and accuracy of missiles can be achieved, they can level targets overseas within a few minutes, using atomic and other warheads. High speed, and high trajectory, might make it impossible for attacked peoples to determine whereabouts of attackers. Present missiles have only guide vanes, no wings. Ordnance claims, with reason, that missiles are new type of artillery. Air Forces, which likes to call them "un-inhabited aircraft," has the advantage of initial experience on problems of long-range bombardment. Aviation, having much prestige, may win in the long run. Regardless of who wins, if missiles should become the major carrier of attack, then military aviation on wings, as we know it, would have nothing left but transport and miscellaneous tactical planes.

Furthermore, much of the military aircraft industry, if missiles take over, would be passed to other than the present manufacturers, as was the case in jet engine development. But stretching vision a little farther, all present weapons including missiles, could become secondary to timed atomic bombs, planted by fifth-column operators. Such warfare could be immeasurably destructive of installations, life, and morale.

Super Speeds

Military air services, National Advisory Committee for Aeronautics, and aircraft industry are working effectively toward transonic and supersonic airplane speeds. Wing sweepback, at an angle of about 35°, seems to be the answer to shock wave, which results in loss of lift and control and creates destructive vibration in planes of normal design. Bell Aircraft, Curtiss - Wright, Northrop, NACA, and others are working on wing sweepback now—also on propeller sweepback.

Army and Navy air forces, and NACA, are hoping to spend one to two billion dollars on a supersonic air research center, including a wind tunnel that would deliver air at speeds up to Mach No. 7, or more than 5000 mph. To do this would require around a million h.p., which may have to be obtained from axial flow water turbines fed for short periods from some high mountain lake, like Crater in Oregon, or Tahoe in California. The Germans used high-pressure water power. NACA has been surveying a site at Grand Coulee, which could supply enough power, but at the expense of other loads.



New Low-cost Landing Gear—Especially designed for private planes, this 90-lb. retractable unit, developed by Electrol, Inc., Kingston, N. Y. is now in use with the Republic Seabee amphibian. These landing gears feature stationary bearings in the oleo assembly, eliminating sliding contact between piston and cylinder wall, and the use of spacers that separate the various elements permitting disassembly of an entire oleo unit in 90 seconds. The power pack is shown below the landing gear. Other models are available for various type planes, with allowances for different load factors.

Bannan Elected President of AGMA; Almen Receives Award

HOT SPRINGS, VA.—The Edward P. Connell Award was presented to John O. Almen at the 30th Annual Meeting of the American Gear Manufacturers Association. The Award was established by the Falk Corp. in memory of its former vice-president, Edward P. Connell, and is made annually by the AGMA.

Mr. Almen, holder of 75 patents on automobile inventions, was responsible for such innovations as resonance intake and exhaust silencers, automatic valve adjusters, the Hydramatic transmission controls, and plate spring clutches. He also designed several machines for testing gear lubricants.

At the meeting, Thomas J. Bannan, president, Western Gear Works, Seattle, Wash., was elected president of AGMA, and Raymond B. Tripp, vice-president, Ohio Forge & Machine Co., Cleveland, O., was elected vice-president of the association. Mr. Bannan had served as vice-president of the group during the previous year.

Air Shipments to South America

SPRINGFIELD, MASS.—Specializing in shipments of all types of machinery, machine tools, and electrical appliances, Norseman Air Transport, Inc., has entered the import-export business, inaugurating three round-trip flights weekly between the United States and South American countries. The number of round trips by the cargo-carrying line will be increased to six weekly when additional aircraft can be secured.

The flights take off and land at Jacksonville and Miami, Fla., connecting with important cities in South America.

Names in the News

Ernest R. Breech

Ernest R. Breech has been elected a director and executive vice president of the Ford Motor Co., succeeding the late **Frank Campsall.** He has been president of Bendix Aviation Corp. since 1942, and a director member of the executive committee since 1937. Mr. Breech will remain as director until the end of the year. Prior to his association with Bendix, he was vice president of General Motors and chairman of the board of several aviation and air transport companies.

Charles W. Perelle, formerly vice president in charge of manufacturing for Consolidated-Vultee Aircraft Corp. and vice president of Hughes Tool Co., has been elected president of Gar Wood Industries, Inc., succeeding **Glen A. Bassett.**

A. P. Hall, general manager of sales, has been elected vice president of American Chain & Cable Co., Inc.

Ralph C. Berg, formerly assistant production manager and assistant plant superintendent, has been appointed production manager of Le Roi Co., Milwaukee, Wis.

M. G. Sedam has been appointed vice president in charge of research and production for the Alloy Rods Co.

J. J. Schmidt has been appointed superintendent of the Landis Machine Co., Waynesboro, Pa., succeding **J. G. Harper.**

George P. Torrence will return on July 1 to the Link-Belt Co., Chicago, as executive vice president and Nov. 1, he will assume the presidency, succeeding **William C. Carter,** who will retire. Since 1936 Mr. Torrence has served as vice president of Rayon Machinery Corp.

Herbert H. Roosa has been appointed sales manager of Manzel Bros. Co., Buffalo, N. Y.

David M. Ramsay, who has been with the National Radiator Co., Johnstown, Pa. for the past five years, has been appointed manager of the Industrial Div.

John Alico has been appointed director of research and development of the National Magnesium Corp.

Herbert T. Florence has been elected president and general manager of The Cleveland Crane & Engineering Co., Wickliffe, Ohio. He has been general manager since 1938 and vice president since 1941. Also, **A. C. Garnett,** formerly secretary and treasurer, has been named vice president and treasurer.

Robert F. Golden, formerly assistant to the president of the National Lock Washer Co., has been named to head the newly established research and development department of the Eaton Manufacturing Co. in Massillon, Ohio.

James M. Underwood has been elected president of the Vulcan Mold & Iron Co., Latrobe, Pa.

W. B. Herbert has been made vice president and general manager in charge of the New York office of The Cinrock Machinery, Inc.

W. F. Rockwell, president and chairman of the Rockwell Manufacturing Co., has been elected to the board of directors of United Engineering and Foundry Co., Pittsburgh.

Wallace N. Barker has been elected to the newly-created office of executive vice president of Pullman-Standard Car Manufacturing Co. Since 1934 he has been vice president in charge of manufacturing and director of plant operations. He is also a director of Pullman-Standard, Pullman-Standard Car Export Co. and the Pullman railroad.

F. Gordon Spurr has been appointed secretary-treasurer of the Empire Tool Co., Detroit. Also, **David B. Grant** has been named assistant sales manager.

Frank C. Lounsberry, former vice president in charge of manufacturing, has been elected to the newly-created office of vice president in charge of methods and processes of Allegheny-Ludlum Steel Corp. At the same time, three other vice presidents were elected: **M. C. Harris,** production; **E. J. Hanley,** finance; and **Clark W. King.**

R. B. Hammond has been appointed general manager, secretary and treasurer of the Bellevue Industrial Furnace Co., Detroit. For the past 20 years, Mr. Hammond has been associated with the Fisher Body Corp., Div. General Motors. Also, **E. W. Schoen** has been named metallurgical engineer of the firm.

Malcolm P. Ferguson, vice president and director of Bendix Aviation Co. has been elected president, effective June 30. In 1919, Mr. Ferguson joined the Eclipse Machine Co., which was acquired by Bendix in 1929, and successively became assistant general manager, general manager of the South Bend Bendix Products division, vice president, group executive and director.

Howard F. MacMillin has been elected vice president of Bryant Machinery & Engineering Co., Chicago. He was associated with the Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio, for 23 years and in 1938 was named president and general manager. Last year he joined Arthur D. Little, Inc., Cambridge, Mass.

M. P. Ferguson

H. F. MacMillin

Wesley J. Peoples was elected chairman of the board and acting president of the United States Radiator Corp., succeeding **L. Gillespie Erskine,** who was re-elected a director. At the same time, **Carroll M. Baumgardner,** vice president in charge of sales, was elected executive vice president.

Robert G. Willaman has been appointed sales manager and director of Peterson Steels, Inc., New York City.

Richard S. Brown, Wilbraham, Mass., has been appointed the agent of the Ferracute Machine Co. and Superspeed Press Corp., Bridgeton, N. J., for all of New England, except Conn.

Harold L. Aldrich has been appointed district representative in the New York office of the General Electric Chemical Department.

Kenneth E. Greene has been appointed to the sales staff of The Dampney Co. of America's Chicago office and **William T. Campbell** has joined the firm in its Philadelphia office.

G. K. Wood has been appointed manager of the Ilg Electric Ventilating Co's. branch in Columbus, Ohio, while **A. B. Davis** has been assigned to the Charleston, W. Va. office. **Carl E. Brock, Jr.** has joined the firm's Pittsburgh branch and **Frank Taylor,** the New Orleans branch.

OBITUARIES

J. E. Kordenbrock

John E. Kordenbrock, 72, passed away as a result of a heart ailment on April 26. Mr. Kordenbrock had served as a demonstrator for the Lodge & Shipley Machine Tool Co. since 1899. During his long career, he covered extensive territories for the firm and he was responsible for the development of numerous improvements in lathe operations.

George A. Lindblade, secretary and treasurer of the Sundstrand Machine Tool Co., Rockford, Ill., passed away April 27.

Herschel M. Tebay, 47, shop superintendent and a director of the Wichita Engineering Co., Wichita Falls, Texas, died April 23 after an illnes of several months.

Paul L. Creighton, 61, passed away at his Cleveland home May 6. He was recently associated with the Brewing Corp. of America as vice president in charge of engineering. He was formerly an experimental engineer for the Marmon Automobile Co., Indianapolis, and with the Peerless Motor Car Co.

BUSINESS ITEMS

The LeRoi Co. is establishing a Cleveland factory for the manufacture of rock drills and related pneumatic equipment for the construction, mining and transportation industries. The plant will be completely equipped with machine tools, modern metallurgical, heat-treating and testing facilities. **Russell R. Morgan,** formerly with the Cleveland Rock Drill Co., will be in charge of the division.

The Geometric Tool Co., New Haven, Conn., has appointed **The Browning Tool and Supply Co.**, 316 E. Wayne St., and the **Fort Wayne Pipe and Supply Co.**, 101-103 E. Columbia St., Fort Wayne, Ind., as its distributors in six Indiana counties.

Peterson Steels, Inc., New York City, has purchased the merchandise inventory, machinery, furniture, fixtures, etc. from **SKF Steels, Inc.,** which has ceased doing business. Peterson Steels, which is now engaged in the same type of business formerly conducted by SKF Steels, is headed by **Nelson S. Peterson,** formerly executive vice president of SKF Steels.

Latrobe Electric Steel Co., Latrobe, Pa., has appointed the **American Steel Export Co., Inc.,** 347 Madison Ave., New York City as sole export representatives for its entire line.

New Departure Div., General Motors Corp. has established a new southeastern territory in charge of **Alwin A. Gloetzner,** former head of the division's Washington office. The new territory includes: D. C., southern and western Md., Va., eastern Tenn., N. C., S. C. Ala., Ga. and Fla.

Genn & Logan, 3959 N. Lincoln Ave., Chicago, has been formed to represent **The C. M. Kemp Mfg. Co.** of Baltimore, Md. Principals of the new firm are **Earl Genn** and **Frederick D. Logan** and the territory of the firm covers northern Ind., northern Ill., southwestern Mich., southern Wis., Iowa, Minn., N. D. and S. D.

The Sheffield Steel Corp. has purchased the Sand Springs, Okla. steel mills which it has leased since 1936 from the Sand Springs Home interests.

Hercules Tool Co., Tulsa, Okla., has moved to its new offices and plant at 1201 West 17th.

Wendt-Sonis Co., Hannibal, Mo., has opened a new plant and warehouse at 580 No. Prairie Ave., Hawthorne, Calif. for the manufacture of carbide cutting tools.

Lovejoy Tool Co., Springfield, Vt., has appointed **The L. A. Benson Co., Inc.,** 4-8 E. Lombard St., Baltimore, Md. as its representative in Md., Del., and D. C. In cent. and west N. Y. the firm will be represented by **Austin F. Logan,** 115 Chippewa St., Buffalo.

The Pittsburgh Gear and Machine Co., Pittsburgh, Pa., has been acquired by **Lou Mervis** and associates. Mr. Mervis has become president of the firm which is continuing operations.

The O. K. Stamping Corp. has been formed in Fort Wayne, Ind., to do contract work in metal stamping and production. **H. J. Cocks,** a partner in the former Morco Manufacturing Co., whose plant the new corporation now occupies, will become general manager.

The Reading Div., Atlantic Plastics, Inc., is now operating under the name of **The Polymer Corp.** as an affiliate of Atlantic Plastics.

Everett B. Evleth, formerly vice president and general manager of the Brown Instrument Co., Philadelphia division of Minneapolis-Honeywell Regulator Co., has established his own business as an industrial consultant. He is maintaining an office in the Terminal Commerce Bldg., 401 So. Broad St., Philadelphia.

Service Machinery Co. has been organized by **Walter B. Drake** and **Philip E. Glick** at 231 Machinery Bldg., 2832 E. Grand Blvd., Detroit. The new company will specialize in machine tools, accessories, special machinery and metal cleaning equipment.

Ronfeldt Associates, Inc., at 150 So. Westwood Ave., Toledo, Ohio, has been formed by **Theodore H.** and **Howard Ronfeldt** and **Theodore Markwood** for the manufacture of machine tools and dies.

The Godfrey Tool & Supply Co. has been organized in Cleveland with **A. H. Godfrey** as president. Offices and warehouse of the firm, which will specialize in the distribution of cutting tools, are at 10012 Carnegie Ave.

National Pumpless Blowtorch Co., 7500 Stanton Ave., Cleveland, has been recently incorporated and will produce a new type blowtorch. Officers of the company include: **E. M. Cline,** president and treasurer; **Parnell J. Porter,** vice president; and **Fred H. Emery,** sales manager.

Chester Manufacturing Co., Lisbon, Ohio, which has operated for the past five years as a partnership, has been incorporated as **Chester Hoist Co.**

MEETINGS

American Society of Mechanical Engineers. Semi-annual meeting. June 17-20. Hotel Statler, Detroit, Mich. Ernest Hartford, assistant secretary, 29 W. 39 St., New York, N. Y.

American Society for Testing Materials. Annual meeting. Hotel Statler, Buffalo, N. Y. June 24-28. C. L. Warwick, executive secretary, 1916 Race St., Philadelphia 3, Pa.

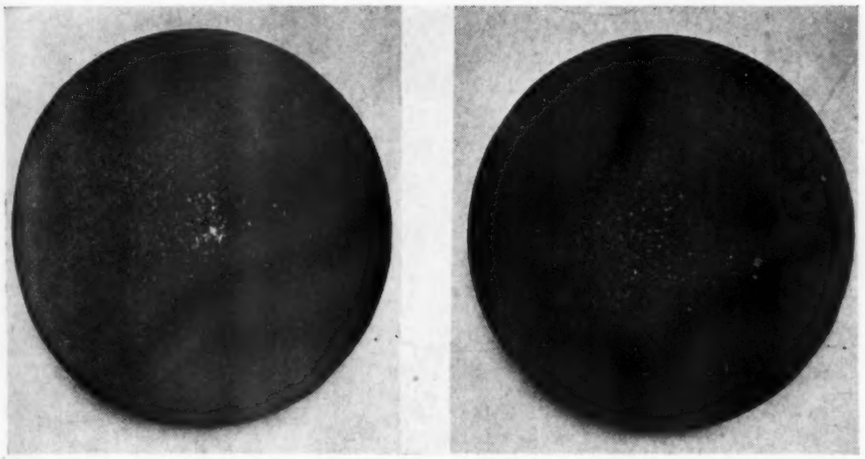
Metal Powder Association. Spring meeting. Waldorf-Astoria Hotel, New York, N. Y. June 13. Robert G. Kenly, chairman, 420 Lexington Ave., New York 17, N. Y.

Society of Automotive Engineering. Semi-annual meeting. French Lick Springs Hotel, French Lick, Ind., June 2-7. John A. C. Warner, secretary and general manager, 29 West 39 St., New York, N. Y.

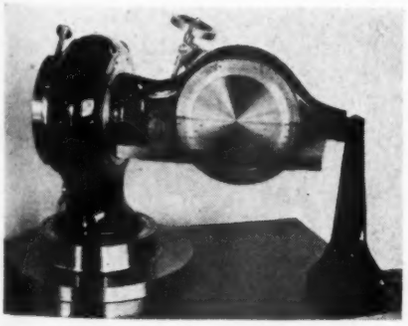
Parts and Materials

Latrobe's Desegatized Steel Has Even Carbide Distribution

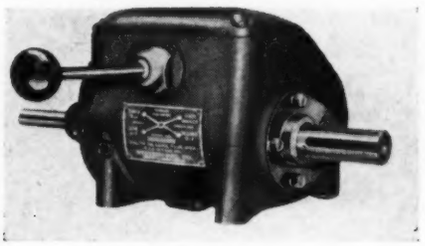
A major improvement in the quality of high-speed steels, achieved by a more even distribution of free carbides in the steel is announced by Latrobe Electric Steel Co., Latrobe, Pa. Eliminating segregation of carbides in the center, the bars and other shapes produced by this process are named Desegatized Steel. In shop performance, this steel is said to show uniformly superior results under heat-treatment, longer tool life, longer run between grinds, reduction of warpage and breakage.



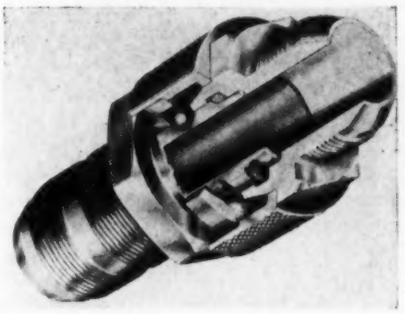
Segregation contrast is evident in these unretouched views of hardened disks cut from steel bars. Disks have been polished and etched. At left is a standard bar of Latrobe 18-4-1 steel and at right an average bar of Desegatized steel



ANGLE COMPUTER—For layout and inspection work the Model "G" Studler Computer has a 9 x 10 in. surface plate. The plate may be rotated 360° in each of three separate directions, and located accurately to 0.001 in. or to 0° 1'. Made by the Angle Computer Co., 1709 Standard Ave., Glendale, Calif.



TRANSMISSION — Especially adapted to flat plate or platform mounting is this 9000-B unit of Western Manufacturing Co., 3400 Scotten Ave., Detroit 10, Mich. It has 5-hp. capacity with input speed of 900 rpm. Four gear changes are available through one shift lever with ratios 1:1, 2:1, 3:1, and 4:1. Four bosses, drilled and tapped are provided for mounting on a flat portion of the machine

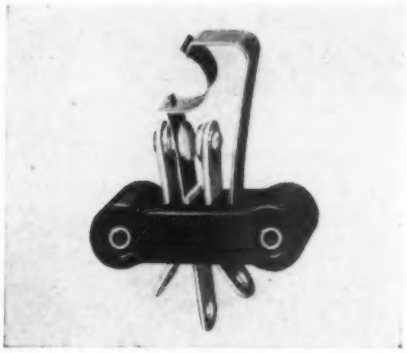


Pressure Used to Tighten Lock On Roylyn Laboratory Coupling

A coupling especially designed for use on hoses and lines operating under pressure has been announced by the Roylyn Mechanical Laboratory, 8928 Santa Monica Blvd., Los Angeles 45, Calif. Suitable for air-driven tools and other uses, the coupling includes a cam ring, ball cage, and nipple. By rotating the cam collar steel balls are forced inward into a groove in the nipple, forcing the halves together. The gasket retained in the ball cage provides a positive seal against dirt as well as being the separating spring force necessary to the operation of the lock. A slight shoulder on the cam assures positive lock—application of more pressure tightens the lock. Couplings are available in aluminum, brass, alloy or stainless steel in standard thread sizes from ½ to 2 in.

Bright-Alloy Plating Has High Conductivity, Does Not Oxidize

Developed for radar applications, but of use now for electrical and measuring instruments and other uses, is a bright-alloy plating material that carries current better than gold and does not oxidize or tarnish as readily. Made by Hanson-Van Winkle-Munning Co., Matawan, N. J., the material (55% copper, 30% zinc, 15% tin) is silvery in appearance and can be soldered with a non-corrosive flux. The deposit is said to be relatively low in cost, adaptable to precision plating, and to have good reflectivity and hardness—Rockwell 50C. It is not a rust-preventive agent in itself, and a heavy copper deposit is required first upon steel articles.



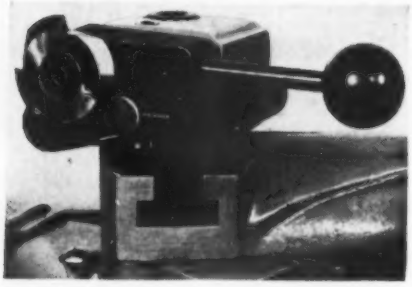
SWITCH—This Model M open-blade snap switch for vertical mounting has unusual compactness for multiple use. Made by Acro Electric Co., 1321 Superior Ave., Cleveland 14, Ohio

High-Speed Zinc Plating Done With Special Anodes and Bath

Cadmium shortage during the war forced development of a high-speed plating process that produces pure, unalloyed zinc deposits, which are highly protective and satin bright to bright in color, according to Hanson-Van Winkle-Munning Co., Matawan, N. J. The limitations of zinc plating were overcome by using zinc-aluminum anodes, a bath containing zinc and sodium cyanides plus high current density and means to keep the solution clean.

A modification of the bath permits zinc plating upon malleable and gray iron castings. If use is such that white corrosion is likely, various film treatments may be applied — chromate, phosphate, and blackening, or a special colorless lacquer may be used. Films may be colored green, yellow, olive drab, or black.

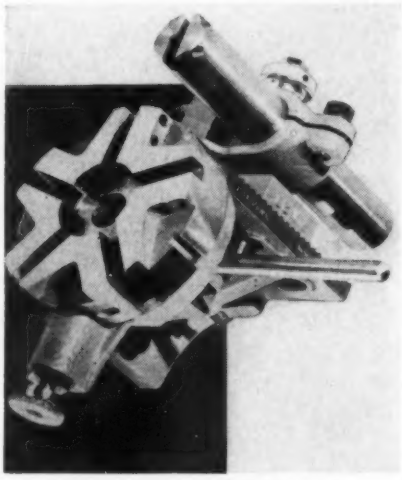
External Thread Chasing Added To Foulk Retract-A-Tool Holder



A formed threading tool arrangement for chasing external threads has been added to the standard tool holders available for the Retract-A-Tool made by the Foulk Engineering Co., 4208 Airport Road, Cincinnati 26, Ohio. The tool has four cutting edges and can be obtained in any of five standard sizes with the proper flat on all edges for 32-18, 16-11, 10-9, or 8 threads per inch, or with one edge arranged for each thread range. These tools can be sharpened off hand on any tool grinder and readjusted to the proper center height by means of a stake adjusting screw.

The Retract-A-Tool automatically snaps the tool away from the work at the end of each threading cut at precisely the same point. This is said to allow increased spindle speeds without danger of the tool digging into the work at the thread ending.

Inside and Outside Machining Done With Lathe Tool Holder



A new vertical precision multi-tool holder said to permit 26 separate operations on a lathe has been developed by True-Line, Inc., Milwaukee, Wis. The turret head holds five tools and, in addition, the holder is equipped with an outboard type of boring bar which permits simultaneous inside and outside machining. The center of the turret is a No. 3 Morse taper to accommodate a reamer or boring bar.

In addition to such standard operations as facing, grooving, threading, turning, and chamfering, it is possible to cut inside and outside tapers at the same time.

Good Points of Air, Hydraulics Combined in New Logan Cylinder

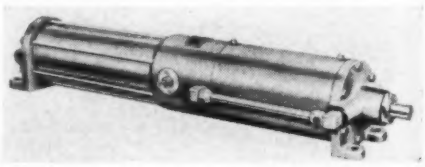
The fast, economical operation of air is combined with the smooth, controlled regulation of hydraulics in the new Air-Draulic cylinders made by the Logansport Machine Co., Logansport, Ind.

Basically the units are air cylinders, and the only external requirements are a source of compressed air. The cylinders have separate air and hydraulic pistons assembled as an integral unit on a common piston rod. Rod movements are powered by the air cylinder.

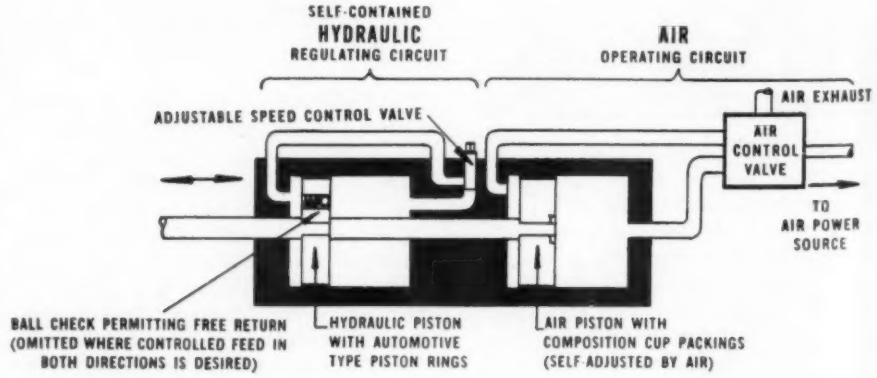
As the piston rod moves, oil flows between the chambers of the hydraulic cylinder, which are connected externally in a self-contained circuit. An adjustable control valve in this circuit regulates the flow of oil and hence the speed of the piston movement.

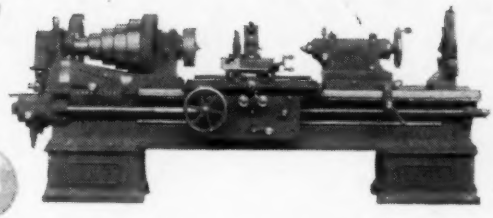
Cylinders can be furnished for controlled feed with rapid return in either direction by installing a ball check valve into the hydraulic piston. They can also be furnished for controlled feed in both directions. Skip feed movements are possible through providing cam valves in the hydraulic circuit.

Cylinders are available in four standard sizes from 3- to 8-in. bore, with any length of stroke to 5 ft. The air piston is built for operation at pressures to 150 psi. Cylinders are available with five standard mountings.



Principle of operation of the air-draulic cylinders is shown in the diagram below. Above the cylinder with foot mountings—one of the five types available





IS "OLD FAITHFUL" PRODUCING *TOO LITTLE... TOO LATE?*

● Are your "Old Faithfuls" producing "too little"? Will outmoded equipment make you "too late" to meet sharp competition? Today there's just one way to measure the value of an old lathe . . . by what it produces. Let's make a comparison.

The faults of the "old timer" above are many. It has single tool limitations, a few speeds and feeds, low power and rigidity. Production is hopelessly low—costs are far too high. In contrast, consider the L & S 2A Duomatic.

Independent front and rear tool slides use multiple tools, operate singly or together—permit a wide range of turning, boring and facing cycles. Responsibility is transferred from operator to machine. An unskilled operator can handle one or more of these fully automatics—produce more than several "ancient" lathes. Even lathes only a few years old are out-dated by this newest Lodge & Shipley Lathe.

L & S Engineers will be glad to show you with cost and production figures and a demonstration on your work—just how a new L & S Lathe will produce more profitably. Write on your company letterhead for new condensed catalog showing complete line of L & S Lathes.

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Shop Equipment News

Landis Centerless Thread Grinder Includes Many Automatic Features

A universal centerless thread grinder, Model No. 1, is now being made by the Landis Machine Co., Waynesboro, Pa. Screw threads can be ground on straight cylindrical workpieces as well as on headed or multiple-diameter parts. Operation is by either the throughfeed or infeed method.

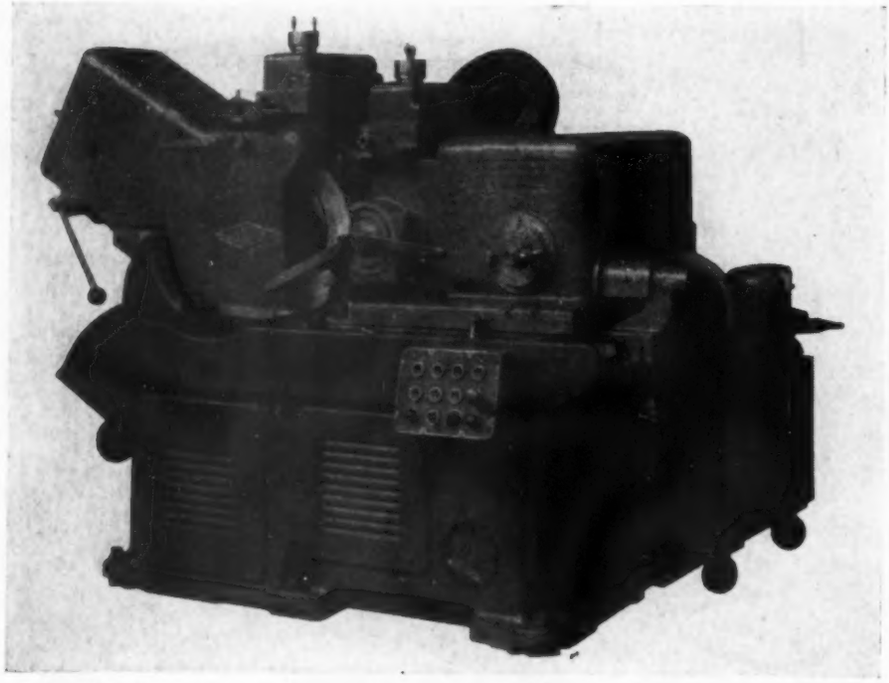
Single-diameter workpieces — such as setscrews, long rods, and rings— are thread ground by passing the workpieces in a continuous flow between the grinding and regulating wheels. This method of grinding screw threads is known as the throughfeed method and can be used to grind threads from either solid blanks or to finish threads pre-cut prior to centerless thread grinding.

Headed or shouldered work—such as capscrews, headed adjusting screws, stripper bolts, and similar multiple-diameter parts—are ground by the infeed method. This type of operation completes the entire thread in approximately 1½ rev. of the workpiece. The workpieces are placed between the wheels one at a time and are automatically ejected at the completion of thread-grinding operations. Grinding may be for either pre-cut threads or from the solid, and is frequently used when the threads must be concentric with an unthreaded portion of the workpiece.

The machine is designed to provide the maximum convenience in setting up and operation. Grinding and control wheels can be dressed without disturbing the setup. The coolant tank is equipped with rollers and is easily detached from the machine. When equipped with an extra coolant tank, a complete change in coolant can be made in a few minutes. Operating controls are centralized at the front of the machine for convenience.

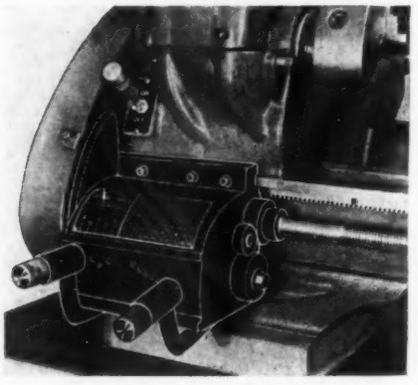
An automatic hopper is available for heading workpieces such as headless setscrews and short rods for throughfeed grinding. When equipped with an automatic hopper the machine is fully automatic in operation except for dressing the wheels and making size adjustments. Efficiency of the machine is such that the period between size adjustments is often extended over several hours continuous operation, and the dressing of the wheels over periods ranging up to 8 hr.

A profile diamond-type dresser is mounted over the grinding wheel and a similar dresser over the control wheel. Each dresser can be equipped with a profile cam to form the face of the wheels to any desired contour. A heavy-duty automatic crush dresser is attached directly to the bed of the machine for forming the thread forms on the grinding wheel. A geared motor is incorporated in the dresser for driving the crusher roll and grinding wheel at a slow speed when dressing. Depth of penetration can be pre-selected when dressing.



Centerless thread grinding by either the throughfeed or infeed method is performed on this Landis machine. When equipped with automatic hopper for feeding work for throughfeed grinding, the machine is fully automatic except for wheel dressing and size adjustment

Western Aircraft Tool Builds Gear Box Attachment for Lathes



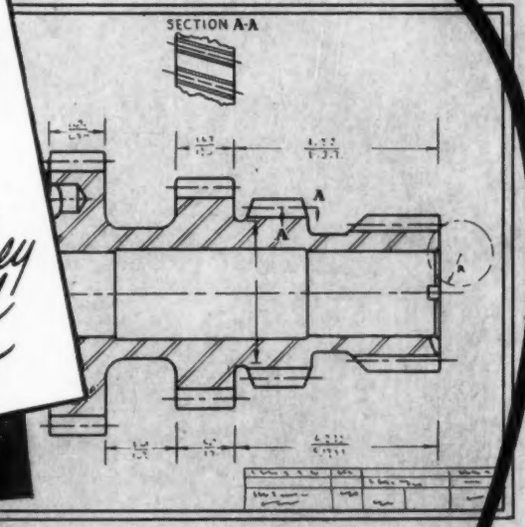
A gear box attachment for Atlas, Craftsman, Logan, Powercraft, Clausing, and Moody lathes is built by Western Aircraft Tool Co., Dept. AE, 650 N. Hoover St., Los Angeles 4, Calif.

The box is said to cut accurate threads from 4 to 224 per inch, with approximately 0.003 in. feed for fine turning. The gear box is installed by drilling and tapping four holes in the

No Divided Responsibility Here

Jack—
This seems like the real way to pin down responsibility on our gear tools. Believe Michigan Tool is ~~the only outfit~~ that produces all types for ~~spurs and helicals~~—from blank to finished gear. Have we got one of their catalogs? If not, let's get one right away—
Bill

P.S. Undoubtedly they can give us some good engineering service, too



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GEAR MILLING CUTTERS	—	GEAR MILLING CUTTERS	MICHIGAN TOOL
SHEAR-SPEED CUTTERS	SHEAR-SPEED CUTTERS	—	MICHIGAN TOOL
—	—	RACKS	MICHIGAN TOOL
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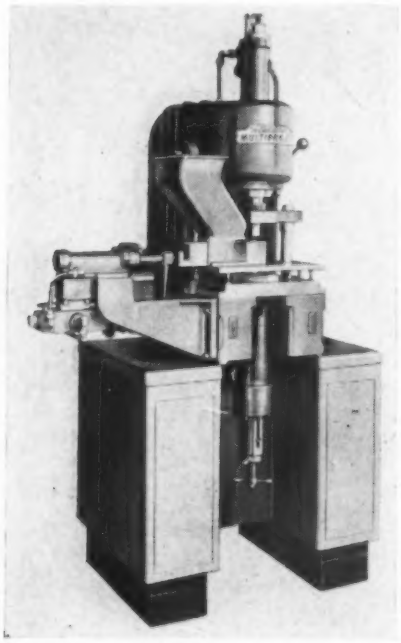
ORIGINATORS of GEAR SHAVING

base of the lathe. Gear changes are made by adjusting the two levers on the gear box. The box is an aluminum alloy casting with replaceable bronze bearings.

Shuttle Feed Accessory Unit Added to Denison Multipress

A shuttle feed accessory for use on their recently introduced Multipress has been announced by The Denison Engineering Co., Columbus 16, Ohio. The accessory can be used for a variety of production jobs, one of which is powder pelleting.



Different filling boxes utilizing the same feed hopper can be provided in variable widths and heights so that minimum pressing ram stroke can be used

When equipped for powder pelleting, a hydraulic ejection cylinder and a hydraulic cylinder for actuation of a powder feed box is installed. All three hydraulic rams are interlocked. Shuttle feed moves the filling box from the powder storage hopper over the die and then retracts, pressure ram descends and forms the pellet, ejection ram raises and ejects the pellet, maintains the pellet above the die surface until the shuttle feed ram again moves the filling box over.

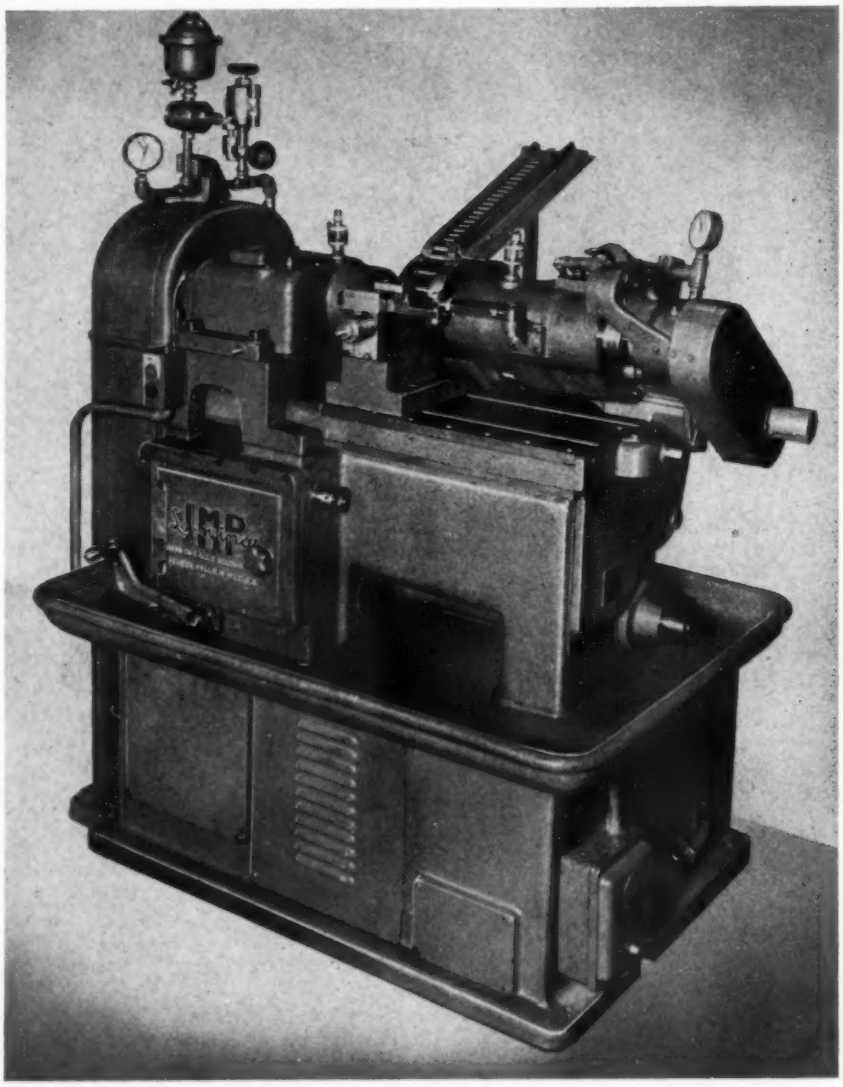
The Multipress units are equipped to provide vibratory action—the press ram can be adjusted to deliver up to 18 short full-pressure loaded strokes in conjunction with each full stroke. The length of these short strokes can be adjusted from 1/32 to ½ in.

Seneca Falls Automatic Lathe Includes a Double-End Drive

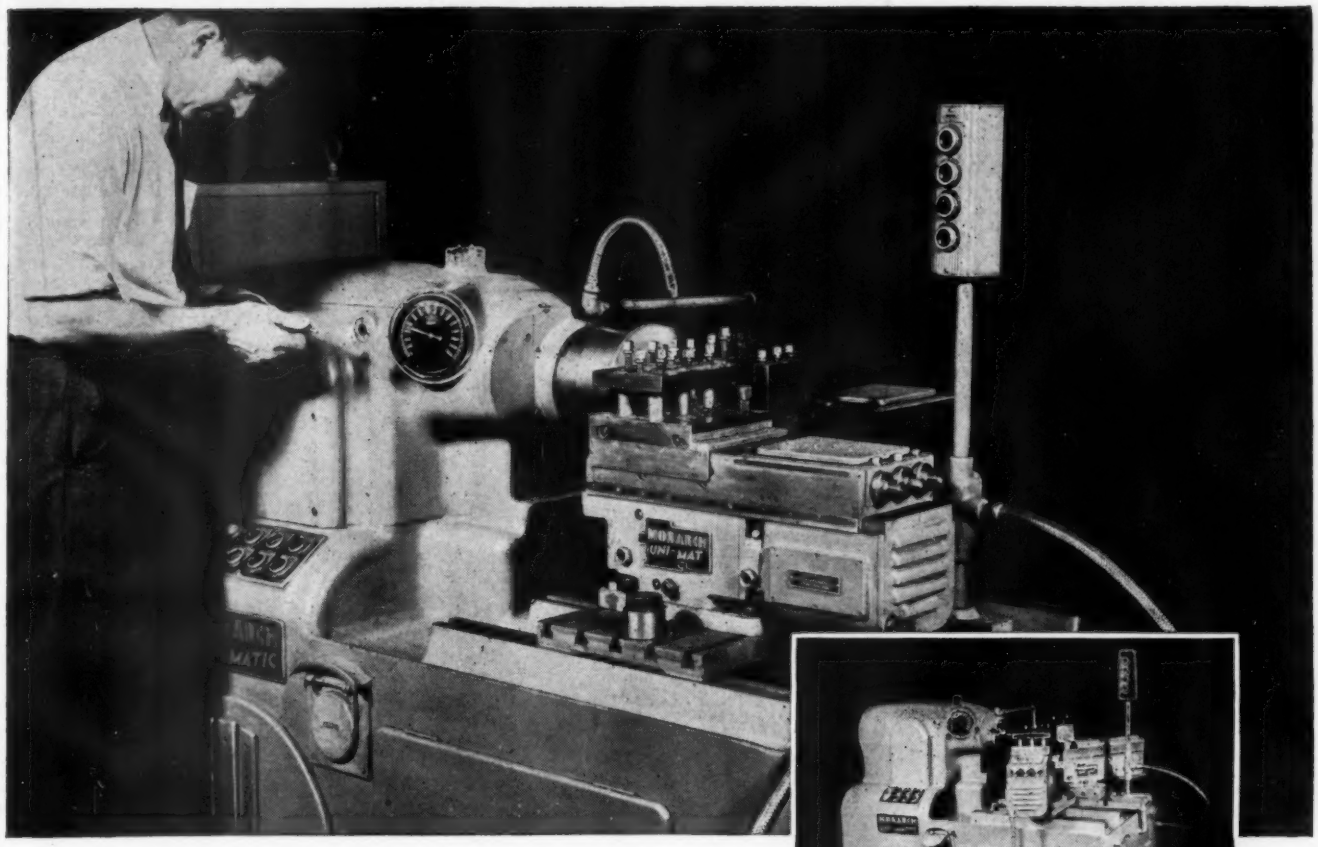
Valve guides and similar parts are automatically turned in a double-end drive automatic IMP lathe built by Seneca Falls Machine Co., Seneca Falls, N. Y. Drive to both spindles is by pulleys and V-belts from a splined jackshaft extending along the rear of the machine.

In the machine illustrated, valve guides which have been previously bored to size are placed in a loading chute and fed by gravity into openings in the rotary loader. The loader indexes the pieces to the proper position where they are automatically picked up by the continuously revolving spindles of both heads. The slots in the loader are slightly larger than the rough parts, permitting sufficient clearance for them to revolve. When the piece has been turned to size, the spindles are backed off, releasing the work. The piece remains in the loader until indexed into the unloading chute, by which time it has stopped revolving and there is no danger of injury to the operator or damage to the part.

Parts may be turned to size with a single carbide tool, or rough and finish turned in the same operation with separate tools. The finish turning tool begins cutting after the roughing tool has been relieved from the work, assuring close concentricity between bore and finish-turned dia.



Double-end drive in this automatic lathe permits coarser carriage feed and eliminates wear on the revolving center



You'll get peak production AT A PROFIT—with the *Uni-Matic**

Spindle speeds up to 5000 RPM. Completely automatic cycle, electronically controlled. Independent-motor-driven interchangeable tool slides ("Uni-Mats") you can position universally, tool universally.

These are just a hint of some of the revolutionary features you'll find in the Uni-Matic . . . for chucking and fixture work as small as 1" and as large as 16" diameter. It's the machine that brings automatic production within reach of every shop, no matter how large or how small the lots.

You'll get minimum machining costs as only you can with specialized automatic production. Best of all, when you change your design you don't change Uni-Matics. Just tailor the tooling to fit your new operation—it's only a few hours' job. The Uni-Matic is universally adaptable.

*** UNI-MATIC** — Add this new name to your metal-turning dictionary—you'll be hearing a lot of it—wherever rising production costs are a factor. The *Uni-Matic* is Monarch's answer to this problem in the field of chucking and fixture work. For between-centers work it's the *Mona-Matic:* for hand screw machine work, the *Speed-Matic.*

Get full details on these three new machines *now* — from your nearest Monarch representative — or write us direct.

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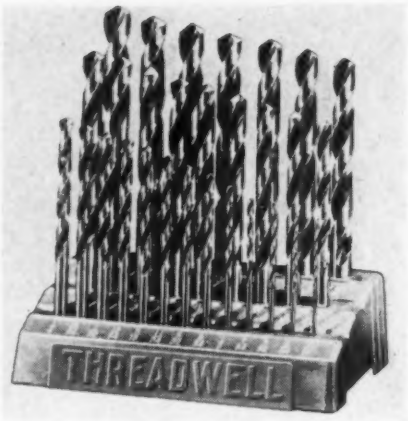
ACCURACY · ECONOMY · LONG LIFE

Monarch
TURNING MACHINES

High-Speed Twist Drill Line Made by Threadwell Tap & Die

A complete line of high-speed twist drills is announced by Threadwell Tap & Die Co., Greenfield, Mass. The drills include high-speed taper-shank drills in all standard sizes up to 1½ in. diameter, and high-speed straight-shank drills in taper lengths, wire gage sizes and jobbers lengths. Sets are available in convenient metal stands, with each size of drill plainly marked on the stand, and in folding metal containers which can be placed in tool boxes.



Sheffield's Gage Checks 32 Points In Engine Block on Production Line

A measuring instrument of extreme precision for simultaneously gaging bore diameters of an automobile cylinder block at 32 points has been developed for Buick by the Sheffield Corp., Dayton, Ohio. Designed as an integral part of a production line, the instrument checks for diameter, taper, and out-of-roundness of eight cylinder bores at four different points in each cylinder, and accurately classifies them to 0.0003 in.

Loading arms advance the block to gaging position where hydraulic plungers locate the block and hold it in place. As an additional precaution, a shot bolt enters the locating hole in the top of the block to insure proper location. Each cylinder bore is automatically entered by a spindle assembly consisting of four spindles that float independently. The spindle can be manually rotated through 180° for out-of-round inspection. If interference is encountered by any set of spindles, the machine will stop and a light will indicate the incorrect cylinder bore. Indicating tubes in sets of four are placed at eye level and marked with selection sizes from 1 to 10. As block is gaged, floats fall in the tubes to a position opposite a number on the scale. Movable tolerance slide for each cylinder can be positioned to determine if all four floats are within the out-of-round and taper limits which are 0.0007 in. If so, the selection size is indicated by the number opposite the float in the right-hand tube. This number is manually stamped on the engine block beside the cylinder bore, with a marking device mounted above each of the eight spindle assemblies. Spindle assemblies are then retracted and the machine is ready to bgin a new cycle.

Hydraulically operated, electrically controlled, and gaging by air flow, the multiple-spindle Precisionaire will accomplish one complete cycle in less than 60 sec.

Motor block in gaging position with spindle assemblies raised in the cylinder bores. Dimensions checked at four points in each bore are indicated by the floats in the tubes at the top of the machine

Kent-Owens Vertical Miller Has Flexible Cycle Control

Independent adjustment of the feed rate for opposite directions of the table travel is a feature of the Model 2-20 vertical milling machine, built by Kent-Owens Machine Co., Toledo, Ohio. This makes possible milling a part at one end of the table at a slow feed rate and setting up an entirely different job at the other end requiring a faster feed rate.

A simple and direct drive is used on the Model 2-20 miller, with only three gear contacts between the standard foot-mounted ball-bearing spindle drive motor and the cutter

Table is 42-in. long by 12-in. wide with a 20-in. travel, with a fully automatic cycle. It can be fed or rapid traversed in either direction, automatically shifted from rapid traverse in either direction, and automatically reversed at both ends of the stroke. It may also be automatically stopped at any point in its travel.

A wide range of spindle speeds

PIERCE and NOTCH at the same time

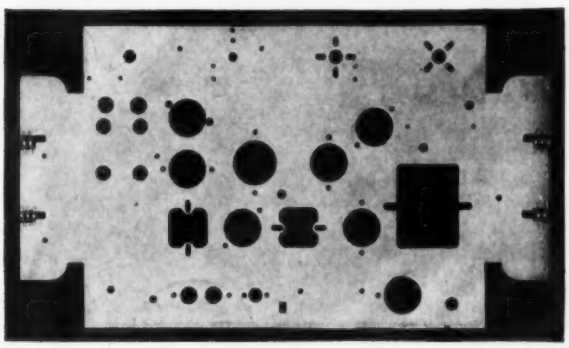
A typical set-up for notching and piercing.

with

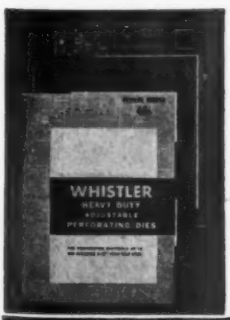
WHISTLER

MULTI-USE Adjustable Dies

Pierced and notched with Whistler multi-use adjustable dies.



You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.



Whistler multi-use adjustable dies are available from stock... a day or two from your plant ...in all standard sizes from 1/32" to 3" diameters... round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for... you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

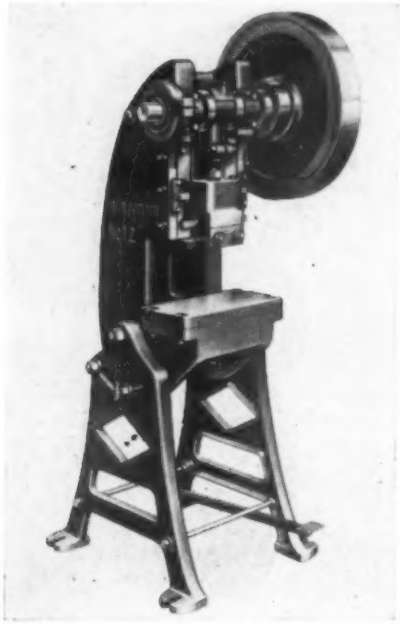
Get all the facts on how Whistler adjustable dies can speed *your* production... cut *your* costs. Write today for the Whistler Catalogs.

S. B. WHISTLER & SONS, Inc.
752-756 MILITARY ROAD BUFFALO 17, N. Y.

WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

may be obtained by changing the spline mounted pick-off gears contained in the head under a light aluminum cover. A medium range of 64 to 860 rpm. is furnished as standard equipment. A low range of 32 to 428 rpm., or a high range of 86 to 1284 rpm., can be provided. Maximum gap between nose of the spindle and the table surface is 10 in.

Diamond Power Punch Presses Are of Compact Construction

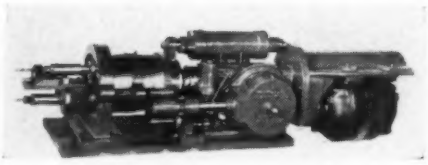


Two new power punch presses, No. 12 and No. 14, are announced by Diamond Machine Tool Co., 3429 E Olympic Blvd., Los Angeles 23, Calif. Of the open-back inclinable type, they are rated at 12 and 14 tons respectively.

The presses have a 6½ in. opening in the back of the frame and will incline 40°. The presses are of compact construction, requiring only 28 x 28-in. floor space. Stroke is 1½ in. for the No. 12, and 2 in. for the No. 14, although special strokes up to 3 in. are available for either press.

Millholland's Automatic Unit Drills and Taps Axle Housing

An automatic drilling and tapping unit developed by W. K. Millholland Machinery Co., 1048 Fairfield Ave., Indianapolis 5, Ind., drills and taps pipe plug holes in automobile rear-axle housing, while other operations are in progress. The unit is mounted on a double-end boring and reaming machine, performing the operation automatically, while the other operations are under way.



The unit consists of a standard motor-driven automatic work unit with a two-spindle head attached and supported in a housing mounted in the same base plate with the unit. The operation consists of rapid approach of drill to work, slow feed for drilling, rapid return, index, rapid advance of tapping spindle, slow tapping operation, reverse tapping spindle, backout, rapid return to position, index ready for next cycle.

LeMaire Hollow Milling Machine Built Up From Standard Units

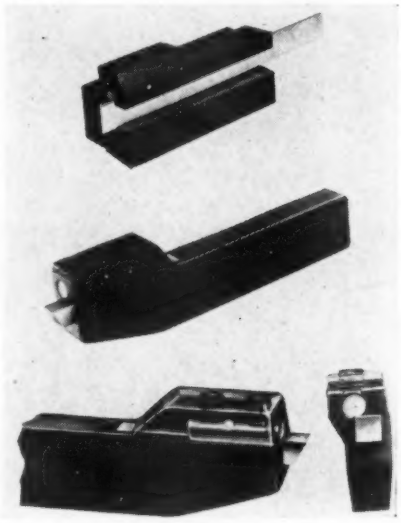
A hollow milling machine for heavy duty work that is built up of several standard elements has been developed by LeMaire Tool & Mfg. Co., Dearborn, Mich. Designed to hollow mill and face the shoulder on universal joint spiders with journals ranging from ½ to 1⅛ in., the machine has a LeMaire No. 5000 hydraulic unit mounted on a standard base for each of the four stations. Each unit can be operated at speeds independent of the other. Infinite feeds are controlled by flow valve and the spindle speeds are controlled by a rheostat located on a variable speed unit alongside the machine. Separate motors are employed to furnish power to the hydraulic pumps and to the spindles.

The air-operated fixture has an electric interlock to prevent cycling of the machine before the part is clamped. A nest arrangement used to locate the part in the fixture facilitates change-overs.

Toolbit Is Clamped by Long Pin In New Cooper-Bessemer Holders

A new line of drop-forged lathe turning and cutoff tool holders with a method for holding the cutting bit rigidly in place is announced by The Cooper-Bessemer Corp., Industrial Tool Division, Mt. Vernon, Ohio.

A patented feature is the clamping pin which engages the bit through nearly its entire length. Two flush-type setscrews lock the bit into position. A dowel keeps the clamping pin from falling out when the bit is removed. This dowel is easily removed to permit taking the clamping pin out when necessary. With this holder the toolbit can be removed for grinding or renewal and replaced in the holder in any desired position without disturbing the adjustment of the holder to the toolpost. Bits are not mutilated by setscrew marks. Unusually short bits can be held rigidly.

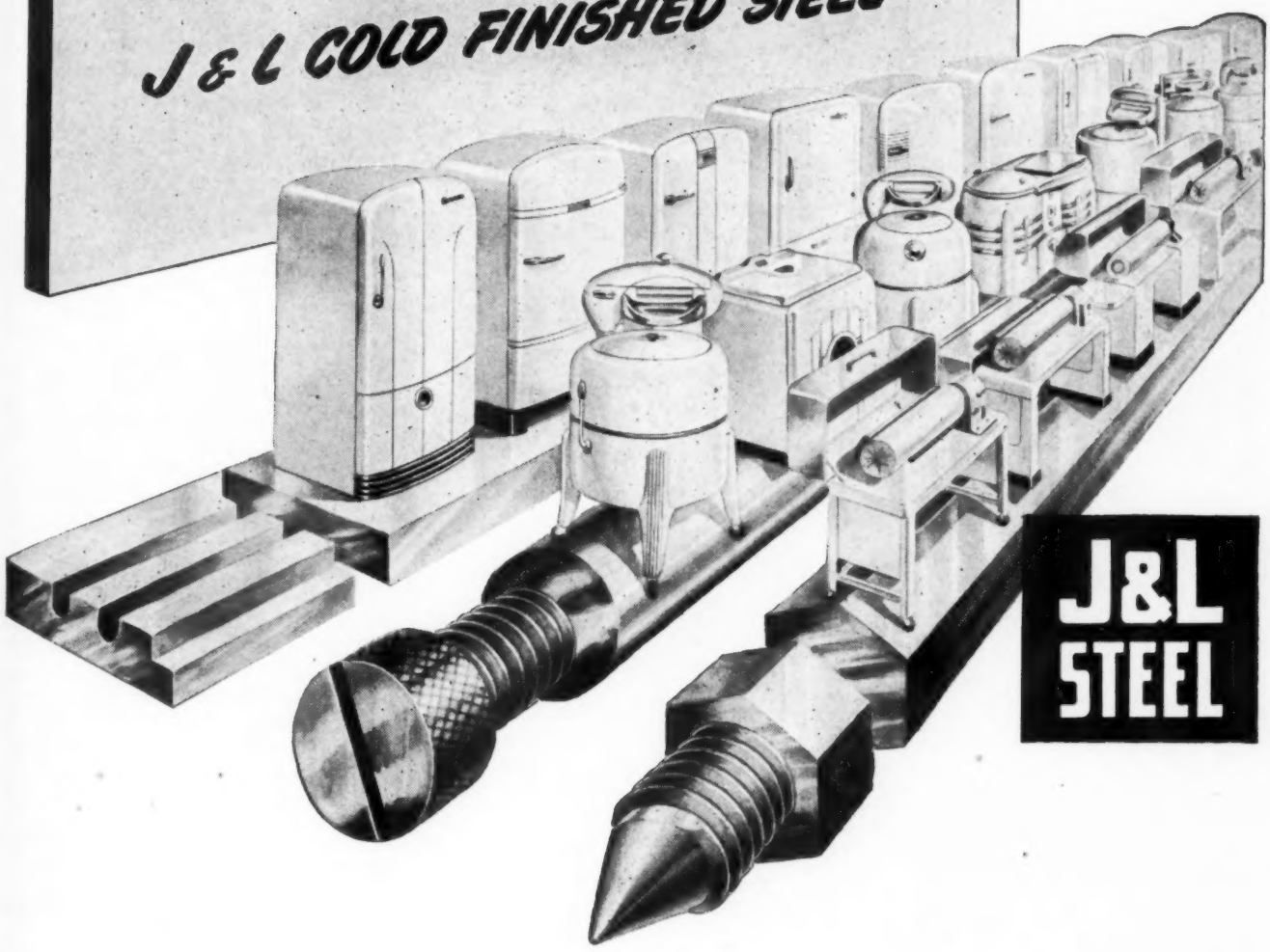


Cut-off and turning-tool holders in which the toolbit is clamped by a pin. Phantom view shows how setscrews lock the pin against the toolbit

Standard units mounted about a central base makeup this machine for milling universal joint spiders

For Accurate Machine Parts at Reduced Cost . . . use

J & L COLD FINISHED STEEL



Your machine parts can be made at lower cost from J&L Cold Finished steel because it is uniform. This means faster cutting speeds, less tool wear for you.

At J&L, steel for cold finishing is made expressly for that purpose. The required quality and grade are specifically outlined when the iron is made in the blast furnace, converted into steel at the Bessemers or open-hearth furnaces and rolled into bars or special shapes. The long experience of Jones & Laughlin in the production of Cold Finished steel from the time the process was invented by them further assures the uniform quality of the product—a quality that will enable you to step up your production of accurate machine parts. Write for further information.

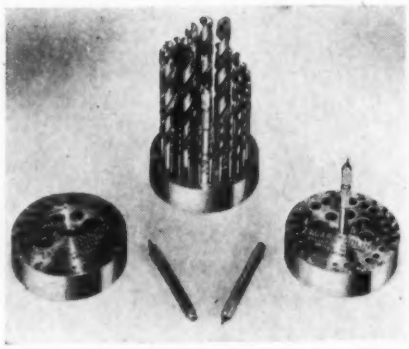
JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

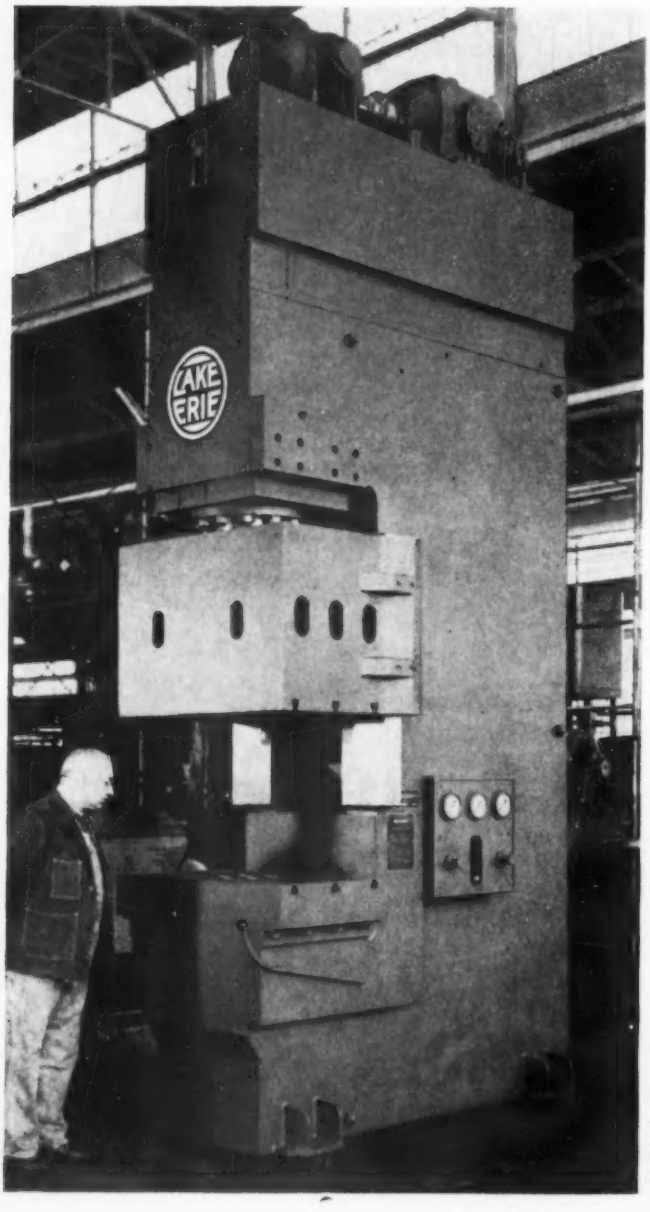
Lake Erie Bending, Forming Press Has 200-ton Hydraulic Operation

A new press for bending and forming steel parts has been developed by the Lake Erie Enginering Co., 507 Woodward Ave., Buffalo 17, N. Y. It is a 200-ton C-frame hydraulic press with a 42-in. right to left, and 24-in. front to back die space. It has a 30-in. daylight opening and 16-in. stroke of the moving platen.

Closing feed of the press is 350 in. per min. and return speed is 345 in. A 35-ton cushion is mounted in the bed. The press is of simple, compact design. Operation is by a hand lever readily accessible to the operator. Sensitive control of operating speed is obtained by direct stroking of the pump.



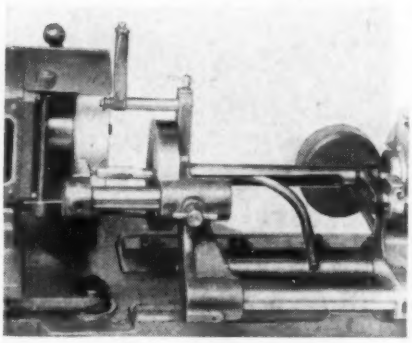
DRILL STAND AND SCRIBER — New drill stand holds 32 drills from 1/16 to ½ in. in multiples of 1/64 in. Toolmaker's scribers use conventional phonograph needles for points. Made by Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17, Ohio



Compact design and fast operation are features of this 200-ton hydraulic press for bending and forming steel parts

Jaws Are Actuated by Single Cam On Edward Blake Universal Chuck

A universal chuck which depends on a single pinion-operated, three-lobe cam to actuate the jaws has been put on the market by the Edward Blake Company, 634 Commonwealth Ave., Newton Centre 59, Mass. Turning a pinion by means of an Allen wrench turns a cam which closes the jaws on the work. A spring acts on each jaw to hold it open when the cam is turned in the pressure-relieving direction.



Used on a tap grinder, the chuck holds 1/16 to 9/16 in. diameter taps, replacing a large number of collets necessary to accommodate this range

The principle can be applied to other types of chucks, both general-purpose and special. It can be made with two, three, or four jaws, which may be formed to accommodate odd-shaped pieces. The thin design is particularly advantageous for applications where overhang must be eliminated or the work area is limited.

Ex-Cell-O Drill Chip Breaker Can Be Operated at Any Angle

A drill chip breaker which breaks the chip at each revolution of the drill, has been introduced by the Continental Tool Works, Div. of Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich. The unit breaks chips into uniform small pieces that are easily carried up the flutes of the drill, which is said to result in increased operating speed and prolonged drill life.

The chip breaker imparts a reciprocating action to the drill which breaks the chips. In operation, the short chips accumulate around the mouth of the hole, eliminating the long spirals which would otherwise be thrown around the machine and on the floor. If the work requires coolant, it flows on the work and down the drill flutes, past the short chips to the very point of the drill without splashing. The unit can be

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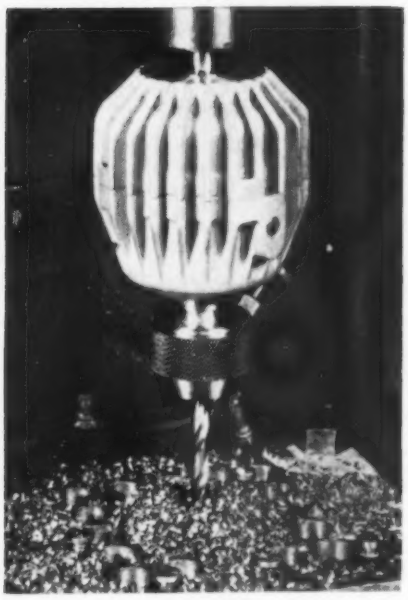
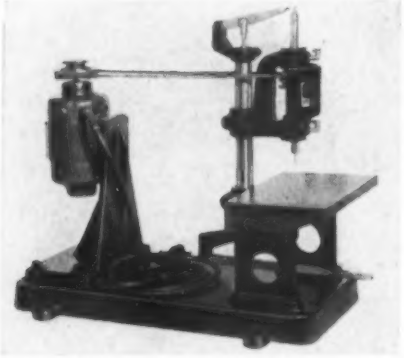


used at any angle at which the housing can be kept stationary while the drill rotates. When space permits, it can be used in multiple-spindle heads.

Lord & Davis Sensitive Drill For Holes as Small as 0.004



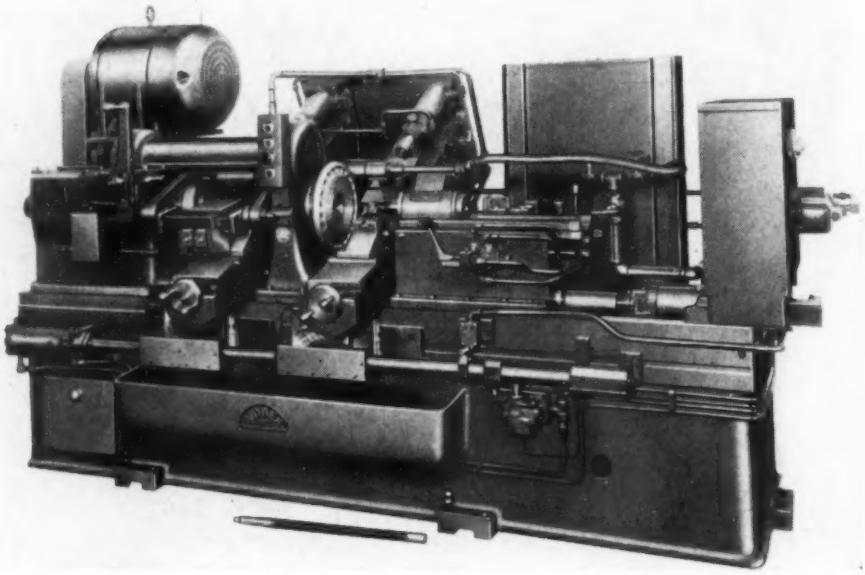
An improved design of its Lord & Davis supersensitive high speed drill press for drilling small holes is announced by Massasoit Machine Co., 232 Grove St., Waltham, Mass. Speed has been increased from 23,000 to 25,000 rpm. A back shaft and idler pulley have been eliminated so that there are less moving parts. A lighter chuck with internal taper holes and a spring to raise the spindle are used to make operation of the machine more sensitive.

A floating spindle, driven by a lightweight woven endless round cotton belt, is operated by a feed control lever so constructed that the drill may be fed with only an ounce of pressure. The machine is so sensitive that the operator can always know the cutting action of the drill. Drill breakage and work spoilage are reduced to a minimum. Holes can be drilled from 0.004 to 1/16 in.

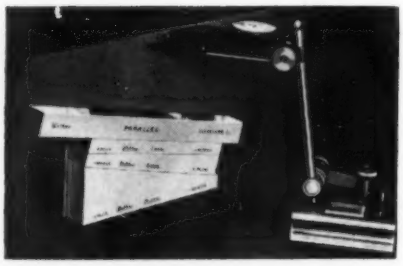
Snyder's Double-End Turning Machine Has Center Drive for Work on Shafts

A special center drive, double-end turning machine with front and rear tool slide for turning shafts is built by Snyder Tool and Engineering Co., 3400 E. Lafayette, Detroit 7, Mich. The front tool slides are for turning the various diameters and forming a taper on one end, while the rear tool slides are for facing, chamfering, or undercutting.

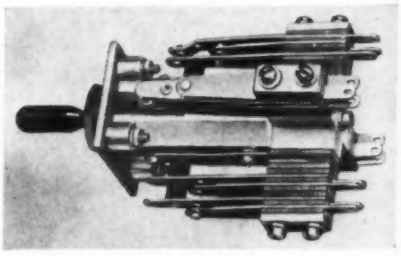
The center drive has three serrated jaws to grip the part, which is held between centers without deflection. The tailstock is well out of the way to permit easy loading, which is done manually, and then the tailstock center is brought in hydraulically. After loading the machine, the center drive is manually engaged. The tool feed is hydraulically actuated through an electrically controlled time cycle. When the turning operations are completed, the cutting tools drop away from the work and then return to the starting position to avoid spiral tool marks on the work.



In the foreground is an automotive axle shaft the ends of which are turned on this center drive machine. The design can be adapted to other shafts of similar construction which need turning on both ends



GAGE BLOCKS—Angle measurements may be made quickly and accurately with the blocks made by the Webber Gage Co., 12901 Triskett Rd., Cleveland 11, Ohio. Accurate to within 1/5,184,000 part of a circle, the blocks produce any angle from 0 to 103° in steps of 1". Working surfaces are optically flat and blocks wring together in the ordinary way



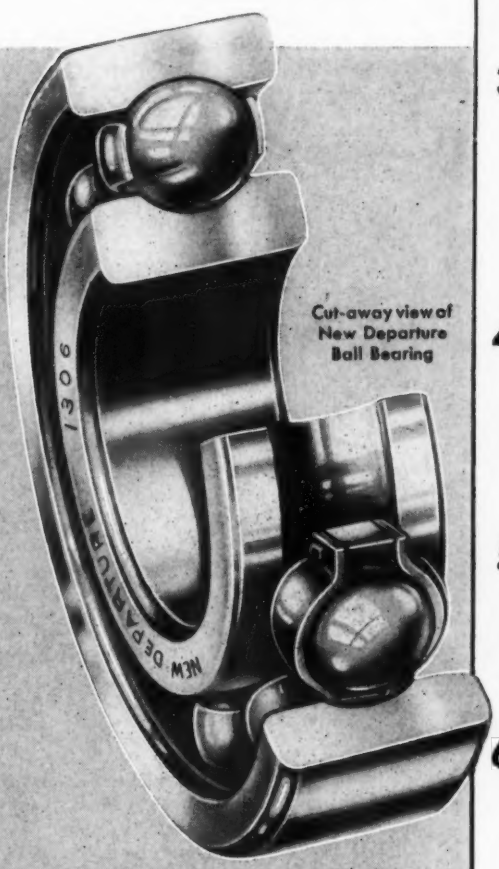
SWITCH — A five-position cam-lever switch built by the General Control Co., 1200 Soldiers Field Road, Boston 34, Mass., has single-hole mounting of the frame to panel and single-bolt assembly of the contact block to the switch frame to give ease of assembly and wiring. Contacts of the model MFC are rated at 10 amp., 125 volts, ac

The bare facts about ball bearings

Rugged New Departure Ball Bearings lick friction with free-rolling, tough, forged steel balls.

They welcome today's more exacting requirements of higher speeds, heavier loads and continued precise positioning of moving parts.

And . . . most important of all, New Departure, world's greatest ball bearing maker, meets your particular problems with a vast fund of experience and original thinking. 3412



Cut-away view of New Departure Ball Bearing

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1 Nothing Rolls Like A Ball. It is nature's favorite, strongest form. Having no ends, it rolls freely in any direction.

2 Under heavy compression it deforms slightly and then resumes its original form. Made of the toughest, most resilient steel known to man, the New Departure steel ball is of uniform structure throughout.

3 Its inherent resistance to load is greatly increased by curved raceways which, under load, are nearly filled by an arc of the ball. "Point contact" talk is the bunk. Actually, its contact is an ellipse, like this:

4 This is how a ball resists thrust (axial loads) as well as radial loads — like a bicycle on a banked track.

5 Put two rows of balls together, and you can support thrust and radial loads from any direction. They may be in one single bearing or in two separate bearings.

6 Unlike other types of rolling elements, the ball need not be forced to travel in the proper direction. Function of separator is merely to keep balls spaced. Contact is at poles (point of slowest rotation—least friction.)

7 Only ball bearings may be self-sealed with integral closures of felt and metal. In average conditions New Departures are lubricated for life. Other type bearings cannot maintain precise "inter-fitment" needed to maintain efficient sealing.

8 Newest new departure *by* New Departure: Lubrication in new sealed bearings may be revitalized by injecting with hollow needle on pressure oiler—without removal of seals or need for nipples, grease passages, plugs.

nothing rolls like a ball

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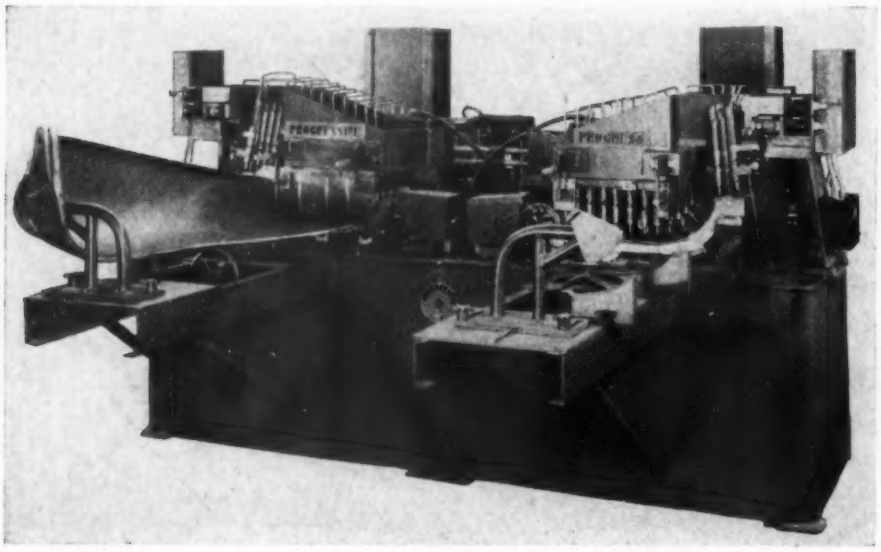
Pair of Fenders Handled Fast On Progressive Duplex Welder

Welding operations on both right- and left-hand fenders are performed on a duplex ultra-speed welding machine built by Progressive Welder, 3050 E. Outer Drive, Detroit 12, Mich. Dust shields are welded to the fender at a rate of 150 units per hour. The two positions can be operated individually or simultaneously.

By supplying an additional hydraulic power unit it is possible to split the machine in two sections and operate them separately. Both integral loading fixtures are provided with adjustable positioning arms for accurately locating the headlamp mounts for a wide range of fender lengths.

Three types of welding guns are incorporated in the machine: a standard direct action type, a bell crank type to provide the greater clearance required at several points, and a floating type gun to provide the extreme clearance required to clear the major flanges.



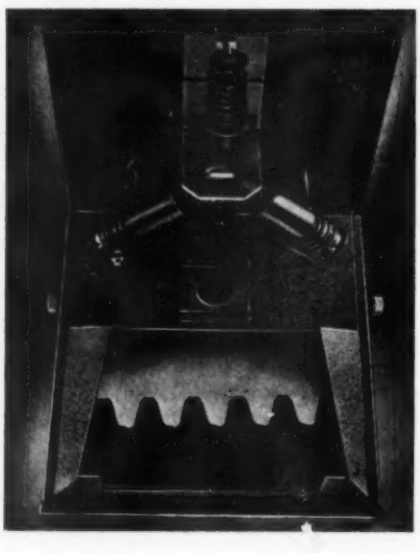
Dust shields are welded to both left- and right-hand fenders on this duplex machine at a rate of 150 units per hour

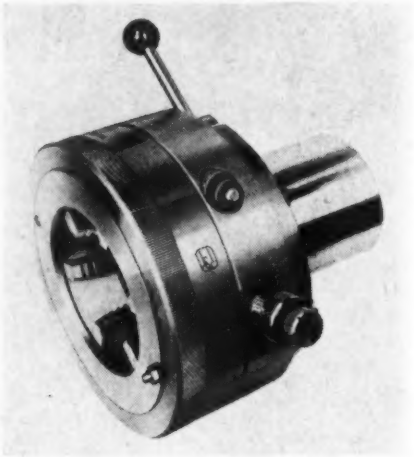
Adjustable Screen Comparator Eliminates Magnifying Errors

An optical comparator with an adjustable screen, the Fish-Schurman, is distributed by the Sheffield Corp., Dayton 1, Ohio. A centering device enables the master pattern to be adjusted to the work, eliminating any magnification of error in the stage which would occur by moving the stage to fit the master screen pattern. Accurate projection of the contour of the part is instantaneous.

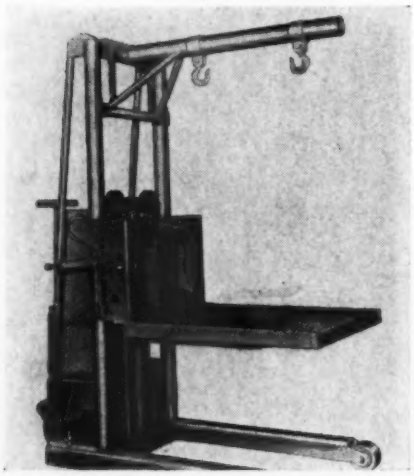
The standard model has a 25 to 1 amplification, while interchangeable 13 to 1 and 50 to 1 optical systems are available. A single adjustment is all that is necessary to bring the image into sharp focus. The comparator can be used in either a horizontal or vertical position.

The construction permits a number of uses in addition to checking and inspecting contours. For example, it may be used for examining contours and fit of small parts in motion with the use of a Stroboscope. It can be used as a strain finder for small objects which require considerable enlargement in order to reveal the strains, replacing photomicrographs.





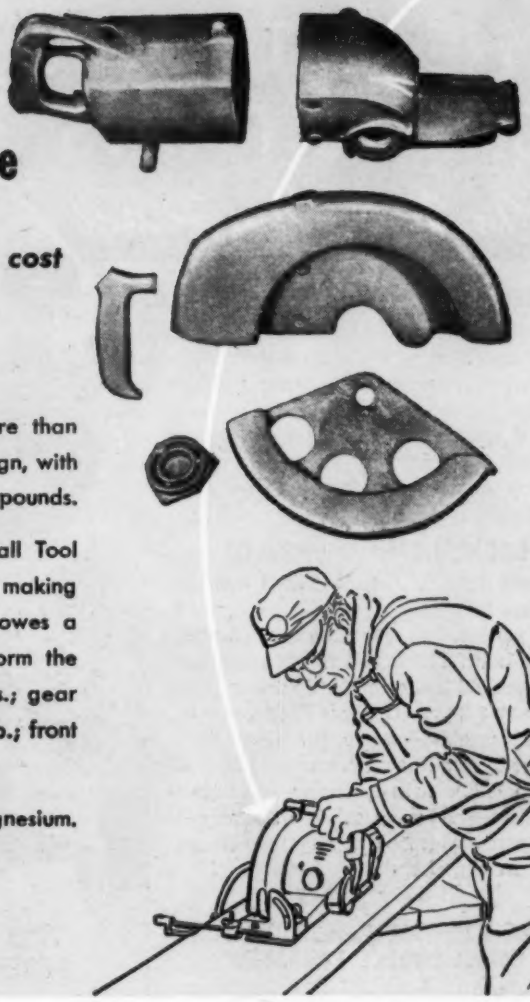
DIE HEAD—This automatic self-opening die head has a threading capacity range from 2½ to 4 in. for heavy duty threading and up to 4½ in. for 8-pitch threads and finer. Built by Jones & Lamson Machine Co., Springfield, Vt., it is hardened and ground on all working surfaces. Chasers are ground in the thread form after hardening and are guaranteed to hold lead correct within 0.001 in. per inch. Built-in eccentric float combined with longitudinal float makes it suitable for heavy saddle-type turret lathe



DIE SEPARATOR—Available for 2000-lb. capacity high-lift truck made by Lyon-Raymond Corp., 2570 Madison St., Greene, N. Y., this die separator consists of a removable boom with adjustable hooks. The top section of die is fastened by chains to the hooks and the lowering of the platform accomplishes the separation. For pulling dies and fixtures in and out of racks and presses a gear type winch with a ratio of 38 to 1 is also available for mounting on the platform

Where lightness cuts . . . fatigue

cuts time . . . cuts labor . . . cuts cost



Here's a sturdy portable power saw built to cut more than lumber! It's cutting *expenses* on many a job. Skillful design, with *lightweight magnesium*, has held its weight down to 36 pounds.

This product is regarded by its manufacturer, The Mall Tool Company, as the most powerful saw of its type for making heavy cuts. Its combination of lightness and strength owes a great deal to the durable magnesium castings that form the motor housing and back handle, weighing only 2½ lbs.; gear housing, 3½ lbs.; upper guard, 2 lbs.; lower guard, 1 lb.; front handle, ¼ lb.; and bearing cap, ⅓ lb.

It's one of many fine new products making use of magnesium. For further information, contact the nearest Dow office.

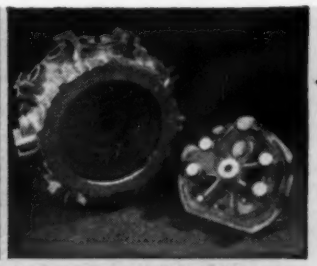
Ready to make products more!

MAGNESIUM

LIGHTEST OF ALL STRUCTURAL METALS

Produced by Dow in ample quantities, magnesium metal is now freely available in all common forms for widespread use.

Many modern plants throughout the country are working with magnesium, following standard procedures and shop techniques.



Magnesium parts of virtually every size and description are being used in a growing variety of fine new products of many kinds.

MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

HEAT TREAT SMALL PARTS
In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

MORE PROFITABLE REASONS FOR USING COOLEY FURNACES

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalzied and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door—Counterweighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand—For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps: 115 V	Watts	Amps: 230 V	Price
MH-3	8"W 6"H 14"L	29.6	3400	14.8	$146.00*
MH-4	10"W 6"H 18"L	——	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

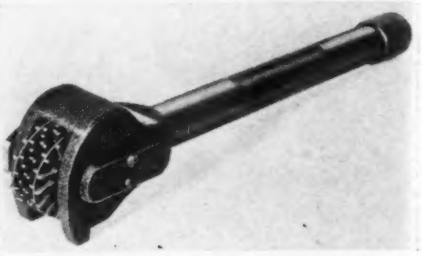
AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—price depends on selection—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

COOLEY ELECTRIC MANUFACTURING CORP.
48 South Shelby Street Indianapolis 7, Indiana
Export Department, 1111 S. Ferry Building, New York 4, New York

Dresser with Forced Lubrication Keeps Grit Out of Tool Bearings



Forced-feed lubrication is used in the Samson grinding wheel dresser, built by G. J. Wallen Mfg. Co., 617 Bryant St., San Francisco 7, Calif. Grit cannot get into this tool, according to the manufacturer, because pressure of the grease prevents grit from feeding back into the dresser. Bosses on each side prevent side play, so that the operator can start at one side of the wheel and work toward the other side cutting under any soft metal such as aluminum or lead with which the wheel may have become loaded. The No. 1 size is used on wheels up to 12 in. diameter, and 2 in. face. The No. 2 dresses wheels up to 60-80 grit with diameters 3 in. and larger.

—130 F. Possible with Dry Ice In a New Cold Treatment Unit

A new development for industrial cold treatment is the Flash Freeze unit made by Super-Treat, Inc., Dept. A, 3412 Beekman St., Cincinnati 23, Ohio. Operating with dry ice, the unit can be cooled from room temperatures to —130 F. in approximately two hours.

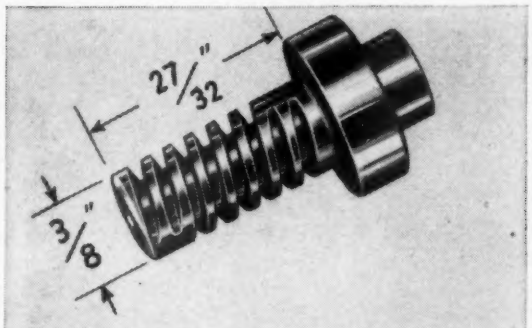
The mechanical equipment is of simple construction, including only a motor and vacuum pump. The unit can be shut down for any period and

SHEFFIELD MACHINE TOOL DATA

TFG #121

CRUSH GRINDING MULTIPLE START WORMS

ON SHEFFIELD PRECISION THREAD AND FORM GRINDER



BRONZE WORM FOR SPEED REDUCTION
32 D.P. — 14½° P.A. — 2 THD. L.H.
PLUNGE GRIND IN 35 SECONDS

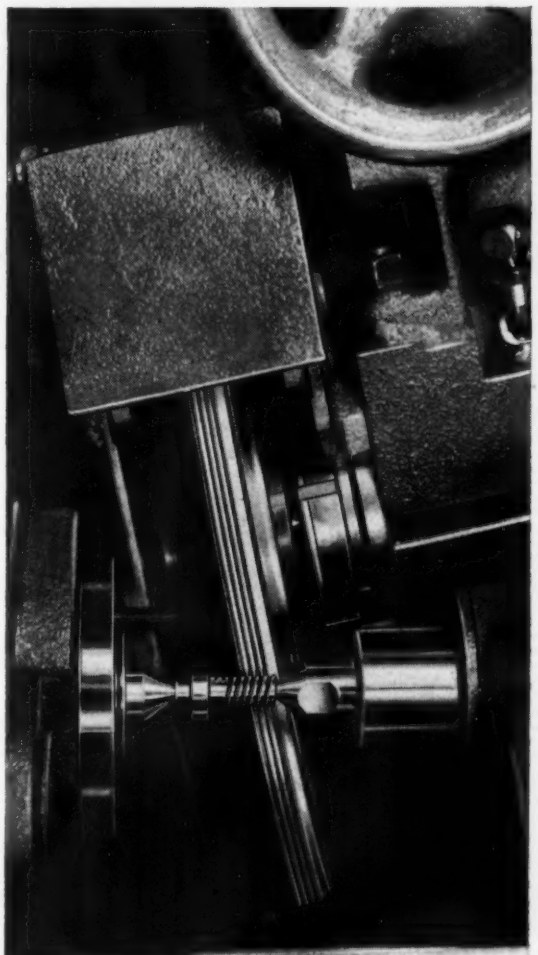
Multiple or single start worms can be quickly and economically produced by Crush Grinding with a Multi-Rib wheel.

Evidence substantiating this statement is incorporated in the following case history.

The part illustrated is a double start 32 diametral pitch worm with conventional 14½° pressure angle. Material is bronze. P.D. tolerance is to be held to .003 over wires. As practically all worms have clearance between the root and the mating worm wheel, a radius at the root presents no problem in assembly.

The multi-rib wheel, crush trued, was set at the required helix angle, 11° 26'. The wheel was briskly plunged to depth inside the outer center of the part so as not to cut through the thrust face. The cut was stopped close to the shoulder of the gear diameter to prevent the wheel marking the shoulder.

The grinding time of 35 seconds produced both starts simultaneously. Burrs



MACHINE SETUP TO GRIND DOUBLE START LEFT HAND WORM WITH CRUSH TRUED MULTIRIB WHEEL. HELIX ANGLE 11° 26'

usually produced in conventional thread milling are eliminated by crush grinding.

In the majority of cases, crush plunge grinding of threads or forms will reduce substantially your present manufacturing costs. Write for Bulletins M-100-145 and M-120-144.

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MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES

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CUTTING TOOLS
Carbide Tipped and
High Speed Steel

TODAY, lowering production cost is a basic necessity for profitable manufacturing. It is here that Midwest's experience, facilities and engineering ability can assist you in selecting metal cutting tools to reduce your production costs. Midwest has been designing and manufacturing standard as well as highly-engineered, special application cutting tools for 35 years.

Send us the details of your metal cutting problems; let us assist you in selecting tools to solve them and lower your manufacturing costs. Efficient tooling means profitable production. Write us today.

If you wish a copy of this bulletin, write us on your company letterhead

Hy-Pressure Lock Inserted Blade Cutter Bulletin 1144

Midwest Tool

CARBIDE TIPPED TOOLS • MILLING CUTTERS • FORM TOOLS
COUNTERBORES • EXPANSION REAMERS • RECESSING TOOLS
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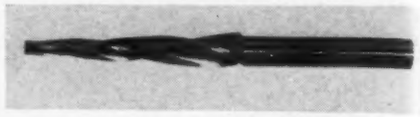
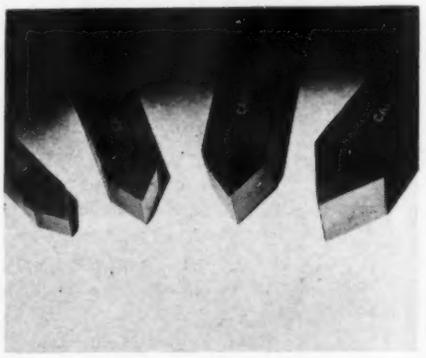
be ready for instant use without complicated adjustment. It can be furnished with either standard or special work baskets.

Tapered Cutting Tool for Dies Is Made with Constant Spiral



A tapered cutting tool or end mill intended for use in making die-casting dies, plastic or rubber molds, wood or metal patterns, has been introduced by the Conical Tool Co., 423 Division, South, Grand Rapids 3, Mich. The tool is made with a constant spiral, with a uniform angle for the entire length of the flute. The tool has three flutes and is said not to chatter at high speed. The degree of taper is said to be exceptionally accurate, enabling the die maker to mill the exact draft required on his die.

Carbide-Tipped Threading Tools In New Carboloy Standard Line



A line of standard carbide-tipped threading tools, Style T-15, has been added to the line of tools carried in stock by Carboloy Co., Inc., 11149 E. Eight-Mile St., Detroit 32, Mich. Tools are of the 60° V-nose type. Tips are of Carboloy grade 78-B, a tough, wear-resistant grade of carbide suited for long-run threading of steel parts.

Gaging Flexibility Gained with New Sheffield Airsnap Fixtures

Standard adjustable Airsnap fixtures for use with Precisionaire instruments have been announced by the Sheffield Corp., Dayton, Ohio. They provide flexibility in checking external dimensions with air and are available in eight models covering a range from 0.250 to 2.000 in. The Airsnap can be used with Sheffield Precisionaires on dimensions with tolerances ranging downward from 0.002 in. Special airsnaps may be used for

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He takes over sales, credit, delivery and other services which, if handled by the manufacturer himself, would increase the latter's supplying costs—and consequently your purchasing costs.

Yes, your industrial distributor does these and many more things in both your and the manufacturer's behalf which it would be uneconomical for either to do independently.

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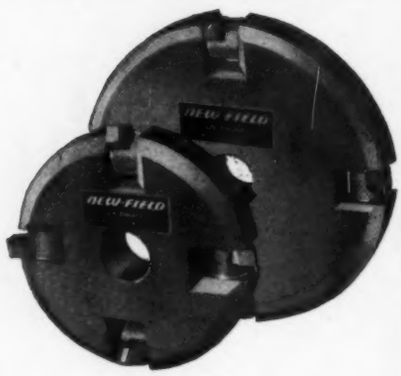
NICHOLSON FILES for every purpose

NOW—2 NEW EXTRA HEAVY NEW-FIELD *Universal* FLY CUTTERS

DESIGNED ESPECIALLY FOR SHELL END MILL ARBORS

Face Milling



For Flat Surfaces — Straddle Milling — Slot Cutting — On All Metals and Plastics

A few of the many cuts which can be made IN ONE OPERATION with the New-Field Universal Fly Cutter

This new EXTRA HEAVY Cutter adds strength for heavier machining. Like other models it uses standard high speed steel or carbide bits—eliminates need for special cutters—speeds production—cuts maintenance and down-time costs.

Fly-wheel action increases cutting momentum—gives more precise finish—less heating of the finished surface. Adaptable for high rate milling on all classes of metals and plastics.

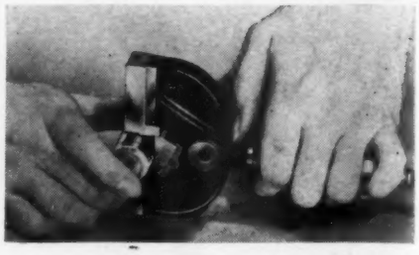
The perfect form of multiple fly cutter—eases load and impact on milling machines, lengthens cutter life between grinds, permits more chip removal per horse power.

4" to 10" diameter—⅝", 1" and 1⅜" (extra heavy) width.

Write now for our latest descriptive bulletin.

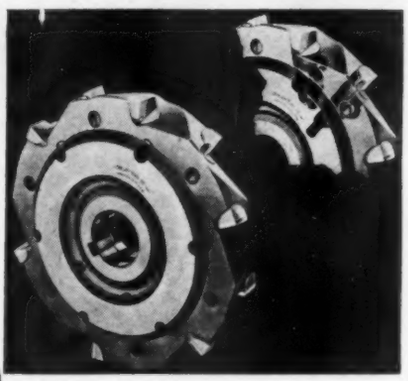
NEW-FIELD MACHINED PARTS CO.
General Offices: 549 W. Randolph St., Chicago 6, Ill.
Factory: 7160 Melrose Ave., Los Angeles 46, Calif.
Export Division: 80 Broad St., New York 4, N. Y.

THE TREND IS TO NEW-FIELD



checking the tolerances of 0.0002 in. down to ten-millionths or less. The airsnap can be used for checking external dimensions of work while mounted in a machine or on a bench, or work too large to be presented to the gage.

Sensitive Blade Adjustment In Lovejoy Slotting Cutter



Sensitive control of blade settings is obtained by the addition of a screw adjustment in the redesigned Type F slotting cutter manufactured by the Lovejoy Tool Co., Inc., Springfield, Vt. Each blade is set at a slight angle to the cutter body. When blade adjustment is required for resharpening or exact control of slot width, the positive-locking device is loosened by unseating a taper pin. A recessed headscrew at the bottom of each blade is then turned to move the blade up or down the exact amount required. When properly set, the blade is positively locked in the body by reseating the taper pin. Cutters are made as standard items in face widths from 7/16 to 1½ in., with diameters 5 to 18 in.

Scherr Tool Grinding Fixture Uses Block to Set Rake Angle

The grinding of cutting tools is made a simple procedure by the All-Purpose tool grinding fixture developed by the George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. The fixture is placed on the magnetic chuck of a surface grinder and held in place by the magnetic power of the chuck. It is graduated by degrees up to 90 and angles both left and right may be obtained. At the same time,

NOW AVAILABLE..Production Tested...

haskins NEW ALL-PURPOSE TAPPING MACHINE

Electric-Air Control is standard equipment on the new Haskins high speed tapping machines. Completely redesigned, these fully universal machines provide every conceivable method of control and allow free interchange of any type of holding fixture—hand fed or automatic.

Electric-Air increases sensitivity in the application of power, permits accuracy in depth of stroke, satisfies the most exacting requirements. Solenoid valves offer automatic or controlled cycle of operation, allow the synchronizing of holding fixtures with the stroke of the tap head.

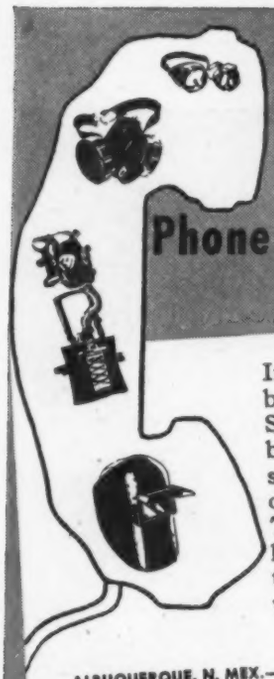
All in all, the Haskins Electric-Air Controlled Tapper is certain to become a most important development in modern tapping history. Send for details.

And, in addition, a new heavy duty machine.

R. G. HASKINS CO. • 2761 W. Flournoy St. • CHICAGO 12, ILLINOIS

HASKINS

haskins ELECTRIC - AIR CONTROLLED TAPPING EQUIPMENT



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In this list you'll find one of your neighbors—a distributor of WILLSON Personal Safety Equipment. That distributor, backed by our 75 years experience in safety service, is well qualified to help you on any eye and respiratory safety problem. That distributor, in addition, maintains a local stock of WILLSON safety equipment to give you what you want—when you want it.

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PRODUCTS INCORPORATED
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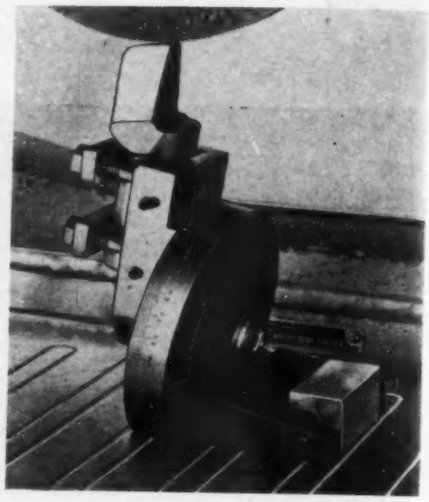
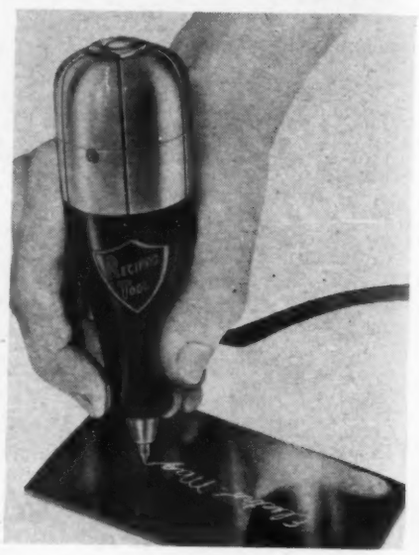


the rake angle is ground by means of a tipping block. Four surfaces underneath the main casting are lapped to match respectively the four surfaces of the block so that 3, 5, 7, or 10° clearance may be obtained by turning the block to the desired side.

Electro-Mag Engraving Tool Is for Continuous Production



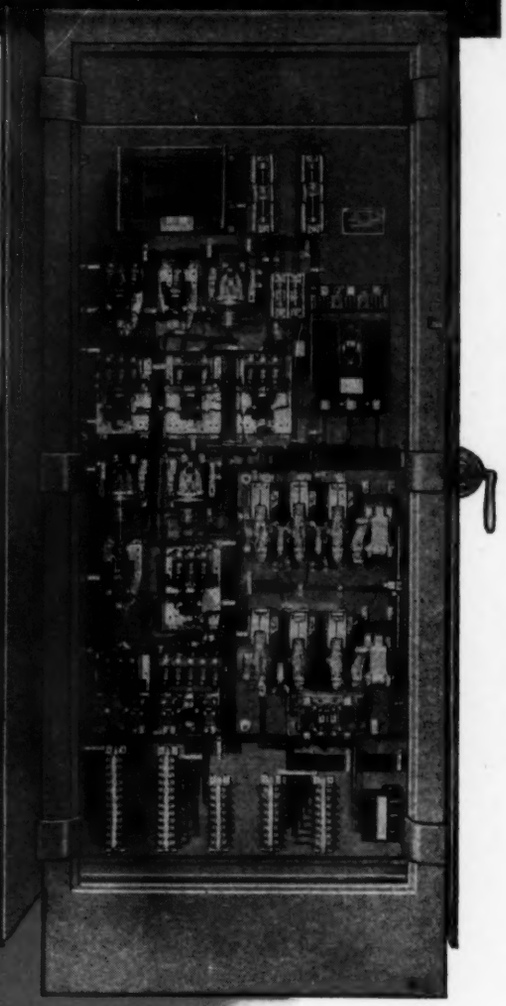
Designed for continuous production work, the Recipro-Tool for engraving any material is made by the Electro-Mag Mfg. Co., 315 So. Madison St., Rockford, Ill. The tool delivers a 5¼ lb. impact with 7,200 power strokes per min. Adjustable from 0 to ⅛ in. The tool is available with a variety of hardened alloy steel bits or with diamond tips. It can also be used for riveting, filing, burring, peening.

More Working Space Provided In Base for Plastic Molding

A new type of mold base to expedite plastic molding has been developed by Detroit Mold Engineering Co., 6686 E. McNichols Road, Detroit, Mich.

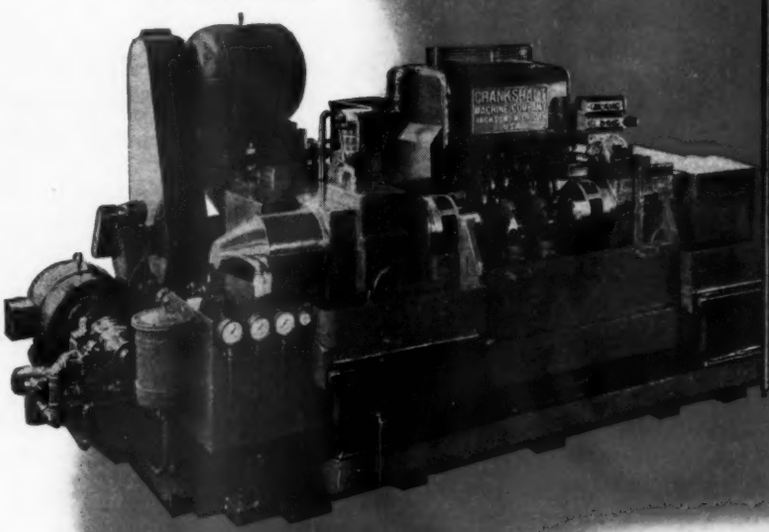
"3C" CONTROL HELPS SPEED PRODUCTION OF CRANKSHAFTS

Crankshaft Machine Company, Jackson, Michigan, builds single purpose lathes to machine crankshafts rapidly, accurately and at low cost—thus helping automotive, aircraft and marine engine manufacturers to handle as many as 45 crankshafts per hour, floor to floor. Machine illustrated is designed to finish-turn crankshaft pin diameters and face pin walls. Clark Control plays an important part by providing full automatic operation.



"3C" Control Panel for Crankshaft Machine. NEMA Type 1A, floor-mounted cabinet.

Crankshaft Machine Co. Type CFB-6LF, Finish Turning Machine.



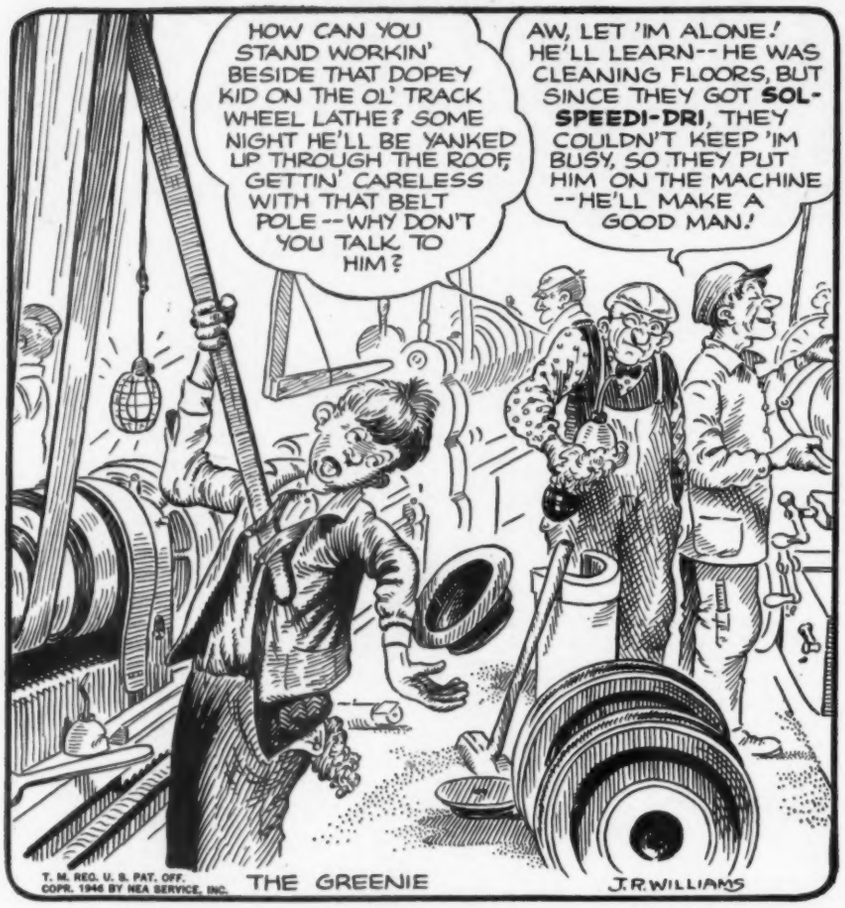
After crankshaft is placed in chucks and starting lever engaged, every operation is automatic. Chucks and steady rests close hydraulically, crankshaft starts to rotate and the table moves to cutters. When machining is finished, table travels to starting position, rotation stops and chucks open. Special controls stop machine if hydraulic pressure drops below required level. If main motor stops, table automatically backs away from cutting tools and machine stops. "3C" Bulletin 100 Type D push-buttons on machine are used for inching during setting up, and for emergency stopping.

Clark specializes in controls for modern, high speed machine tools. Let Clark engineers help you design the proper controls for your equipment.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

OUT OUR WAY

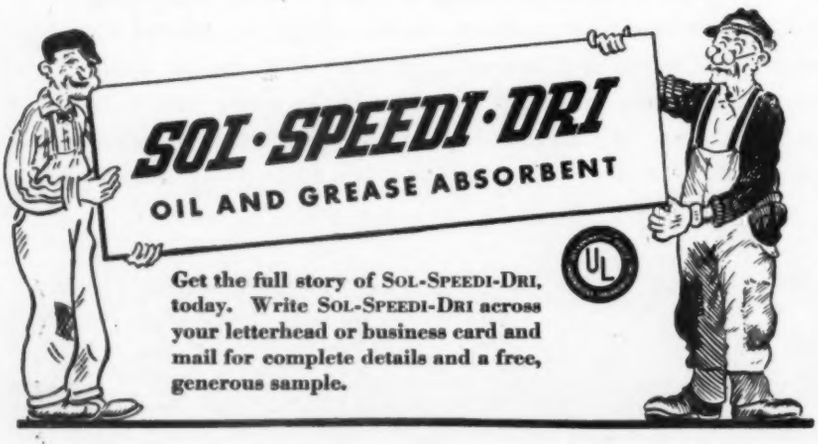

HOW CAN YOU STAND WORKIN' BESIDE THAT DOPEY KID ON THE OL' TRACK WHEEL LATHE? SOME NIGHT HE'LL BE YANKED UP THROUGH THE ROOF, GETTIN' CARELESS WITH THAT BELT POLE--WHY DON'T YOU TALK TO HIM?
AW, LET 'IM ALONE! HE'LL LEARN--HE WAS CLEANING FLOORS, BUT SINCE THEY GOT SOL-SPEEDI-DRI, THEY COULDN'T KEEP 'IM BUSY, SO THEY PUT HIM ON THE MACHINE --HE'LL MAKE A GOOD MAN!
T. M. REG. U. S. PAT. OFF. COPR. 1946 BY NEA SERVICE, INC.
THE GREENIE
J.R.WILLIAMS

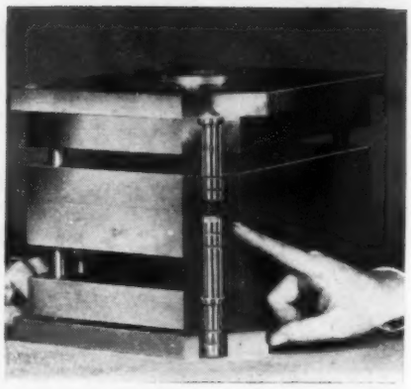
SOL-SPEEDI-DRI SAVES MANPOWER

THAT'S RIGHT! SOL-SPEEDI-DRI . . . the white, granular oil- and grease-absorbent . . . makes floor-maintenance a one-man job. Just spread it around . . . and immediately, you've got a carpet of safety underfoot . . . safe for walking, safe for working. Sweep it up . . . and SOL-SPEEDI-DRI brings with it dangerous, unsightly oil- and grease-deposits . . . making floors home-clean.

No complicated machinery . . . no trained personnel . . . is required to use SOL-SPEEDI-DRI. It's economy-wise . . . because it releases cleaning-personnel for more productive jobs. It's production-wise . . . because it keeps men on the job . . . free from the hazards of oil-slick floors. In addition, SOL-SPEEDI-DRI reduces the danger of fast-spreading flash-fires. It will not readily burn . . . even when completely oil-soaked!

SUPPLIERS:— *East:* Safety and Maintenance Co., Inc., New York 1, N. Y.
South, Midwest, and West: Waverly Petroleum Products Co., Philadelphia 6, Pa.


SOL·SPEEDI·DRI
OIL AND GREASE ABSORBENT
UL
Get the full story of SOL-SPEEDI-DRI, today. Write SOL-SPEEDI-DRI across your letterhead or business card and mail for complete details and a free, generous sample.



The base, illustrated in a cut-away model, has return pin installed directly in line with leader pin. Dowel pins are completely eliminated in the cavity retainer plates. More working space is available for location of water-cooling lines and core-pulling devices.

The new base will be available in nine standard sizes, 9 x 12 in. to 18 x 36 in. The new base is said to provide better cooling, faster operation, and to permit running more mold cavities in the same amount of die area.

Federal's Press-Type Welder Has 30, 50, 75 Kva. Capacity

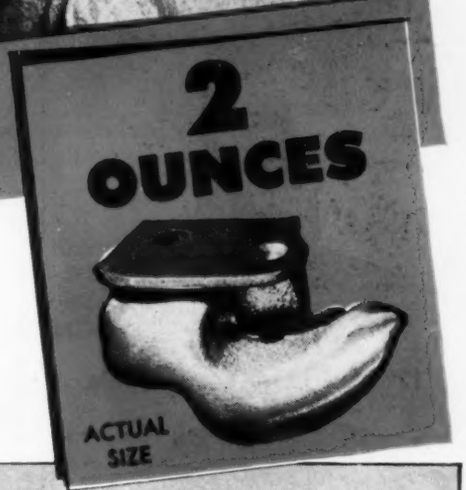
An automatic, hydraulically operated press-type welder in 30, 50 and 75 kva. capacities is announced by Federal Machine and Welder Company, Warren, Ohio. Suitable for either spot or projection welding, the machine applies welding pressure through an inverted-type hydraulic cylinder. The cylinder is a part of the slide or ram, while the piston is the fixed member. The heavy transverse, adjustable spring by which the piston is fixed to the welder actuates a switch initiating the timing controls and provides a quick reaction for a fast follow up on the welding stroke.

After the welder is set for a specific job, the only control needed is a foot switch attached to a flexible cable. A single light pressure and release puts the welder through one complete welding cycle. Speed of the weld is governed by timing controls.

Cleveland Automatic Die Caster Has Double-Compartment Furnace

Complete elimination of cold metal from the shot furnace, improved hydraulic performance, automatic timing, and improved adjustable bearings are said to be characteristic of the Model 400 die-casting machine made by the Cleveland Automatic Machine Co., 2261 Ashland Rd., Cleveland 3, Ohio. The machine is available for

68 TONS or..

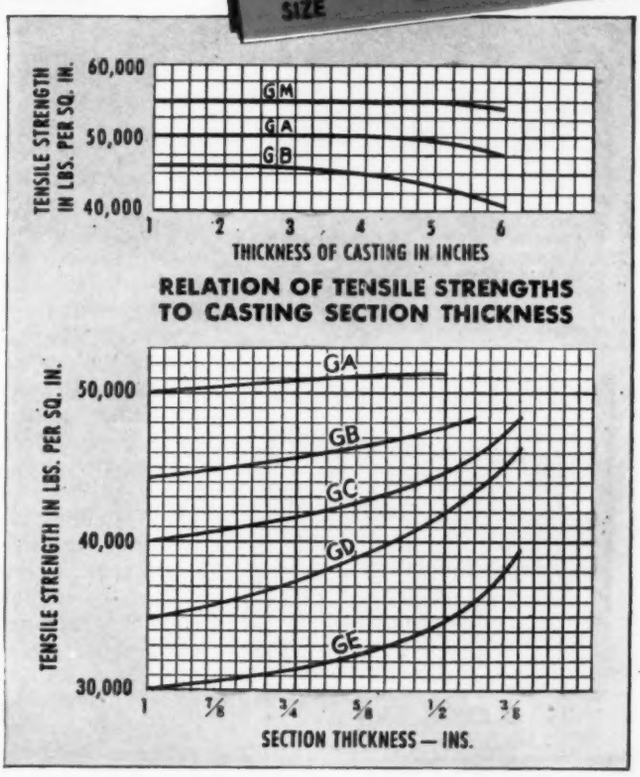


MEEHANITE ASSURES BETTER PROPERTIES!

The 68-ton Meehanite Casting illustrated forms the bed of a stone crusher capable of reducing large pieces of rock to crushed stone. Meehanite was selected because it provides the required high strength and wear resistance. Since the casting was machined at the quarry easy machinability was required.

In the small 2-ounce shuttle part, Meehanite manufacturing techniques provide the metallurgical control of structure and the "know how" in the other elements of foundry practice necessary to produce this casting in quantity and with the required characteristics.

Write for our new four-page bulletin "Meehanite Quality Control Assures Uniform Dependability."

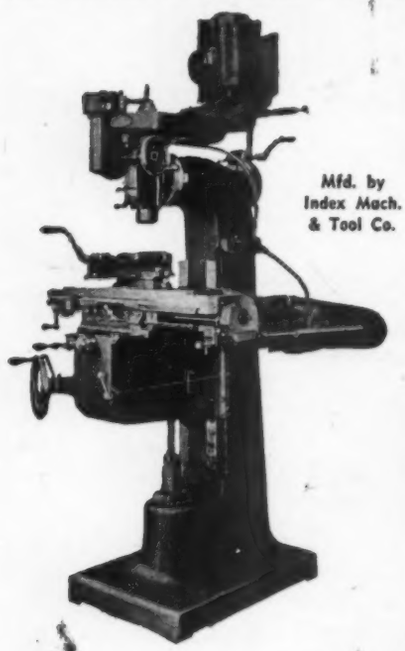


MEEHANITE

Pershing Square Building, New Rochelle, N. Y.

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table

A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

zinc, tin, and lead casting, or for magnesium, aluminum, bronze or brass.

All toggle and pump mechanism is inclosed in steel guards. Guards are removable to permit ready access to working parts.

A double-compartment furnace on the zinc-tin-lead machine, with separate automatic burners for each compartment, does away with cold metal in the shot compartment. New metal is placed in the second compartment, automatically causing the overflow of readied molten metal into the shot section. Even temperature and uniform condition of the shot metal are maintained by this method.

A new heat-exchanger oil cooler gives improved uniformity in hydraulic performance.

Totally Inclosed G.E. Motor Will Handle the Dirty Work

A new totally inclosed, fan-cooled motor, especially designed for use in extremely dusty, dirty, corrosive atmospheres has been added to the line of Tri-Cla induction motors built by General Electric Co., Schenectady, N. Y. The motor is available in standard, explosion-proof, and dust-explosion-proof types from 1 to 1,000 hp. Its compact construction makes it especially suitable for machine tool applications where the motor must be part of the driven machine.

The motor has a double shell with the inner shell completely sealed. Long, close-running shaft fits, supplemented by a rotating seal, keep dirt from entering the motor along the shaft. Cooling is by an external fan protected by a cast-iron housing with a screened air-intake opening. The motor is suitable for full-voltage starting, permitting simple control equipment. The motor has high pull-up torque for snappy acceleration, and high running torque to meet temporary abnormal peaks and low-voltage conditions.

ROUND TABLE DISCUSSION

WINDOWLESS SHOPS?

This subject is an interesting though controversial one. In many factories —especially in ultra-modern establishments which "enjoyed" windowless air-conditioning during the war— it has been one of the chief topics of conversation and real honest-to-goodness arguments. It has often led to serious verbal clashes between shop members and the boss.

There is no denying the fact that air-conditioning has a place. Most people will even go so far as to agree that it is here to stay; it isn't just a fad. To merit that kind of talk, air-conditioning must have certain advantages. Well, let's see what the situation was in a windowless, air-conditioned, indirectly lighted war plant from the time of Pearl Harbor to the end of the war. First, here are some of the advantages:

1. It was comparatively easy to keep the place clean. There were no windows and very few doors through which dust and dirt could come in. Cleanliness is an important item in a shop where close limits are observed and where a box of gage blocks is the Bible.

2. Because the temperature was more or less constant, maximum accuracy was obtained on machines.

3. Air-conditioning brought comfort to those who suffered from summer heat blasts.

4. Drafts were reduced to a minimum. There were no arguments over opening and closing of windows.

5. Because of indirect lighting, glare was reduced to a minimum.

6. It was possible to maintain a spotless, cool, verminless cafeteria.

It is evident, therefore, that for the inanimate machines and machined parts the situation was not far from ideal.

Perhaps if you were going to build a shop of your own, your plans wouldn't be far different than those used in erecting the kind of plant just described if you consider the whole thing from the standpoint of cleanliness and accuracy. Now, what's the story on the other side of the fence?

1. Unofficial tests showed that approximately ½ hour after the shop workers entered the building they grew "tired." The human body became "starved" for something or other. The air in the room (machine shop) did not completely satisfy the

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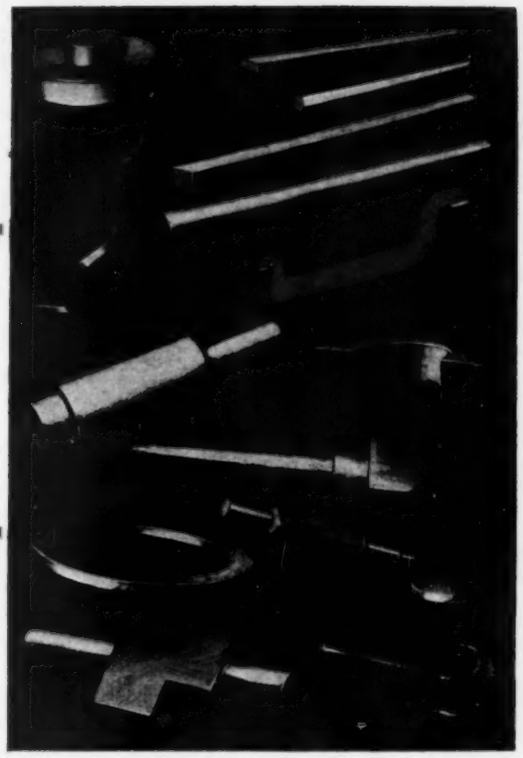
FLAT DIE FORGINGS TO IMPROVE EVERY EQUIPMENT



Better Performance

Many machines and equipments can be improved to better withstand the abuse of constant service by the broader use of flat die forgings. The greater strength which only the forging process imparts to metals assures parts of ultimate ruggedness.

Availability

Kropp Forge is able to offer immediate delivery of flat die forgings—in almost any size or quantity. There is no need to delay your production schedules by waiting for machine parts produced by other methods.

Materials on Hand

Our production stocks of forging steels of various sizes and specifications are unusually large and complete—which gives further assurance of prompt production and shipment.

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Our fully equipped flat die department includes a large number of steam hammers, ranging from 1,000 to 14,000 pounds rating. Each hammer is equipped with one or more furnaces and a full complement of forging tools, including special tools designed by us for the production of what others term "impossible" flat die forgings.

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We have complete, modern facilities for performing any type of heat treatment or machining operation that our customers may require. When you order forgings from Kropp, the forgings, machining and heat treatment can be included in the same order—complete production from a single source with undivided responsibility.

The Human Element

The veteran hammersmiths in our flat die department provide a full measure of the skill which has always figured prominently in the successful production of intricate flat die forgings.

Background

Since the beginning of this century, flat die forgings bearing the Diamond "K" mark have enjoyed an enviable reputation for quality and uniformity.

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SEE

WHAT STANDS BEHIND Increased Production from Precision Sawing

Precision sawing, with its saving in man-hours, results from the manufacture of hack saw blades to carefully checked tolerances in every small detail. In Capewell precision hack saw blades accuracy is given by the many manufacturing refinements developed during Capewell's sixty-five years of pre-eminence in metal working. Ask our distributor to show you how Capewell hack saw blades can increase your efficiency.

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CAPEWELL
HACK SAW BLADES
The trend is to TECHNITE.
the molybdenum high speed hack saw blade

respiratory organs of the workers.

2. The air-conditioning system seemed inadequate thoroughly to clean the air of oil because some workers suffered skin troubles. These skin afflictions disappeared when the members stayed away from this air-conditioned "heaven."

3. Some members suffered from continuous colds. They got rid of these colds only when they quit their jobs and obtained employment elsewhere.

4. Some members lost weight. They gained weight after leaving the place for good.

5. When everyone went to lunch at one time, the temperature went down from 10 to 15°. The number of employees at this particular plant varied from 1,000 to 1,800.

6. Indirect lighting which usually accompanies air-conditioning is not always what it's cracked up to be. Slide-rule calculations make it appear grand on paper, but common sense is still the best rule when it comes to accommodating the human eye. Indirect lighting is oftentimes insufficient lighting. It looks "pretty," but at the expense of the workers' eyesight.

7. There is no evidence on hand that sickness is reduced by depriving a shop of windows and replacing them with air-conditioning. On the other hand, there is plenty of proof that the contrary is true.

Perhaps the psychologists will attribute some of these gripes to nerves, but you can't sell the idea to the people who have had to work and suffer under the above conditions.

The biggest trouble seemed to be management's indifference to the complaints. No one bothered to investigate the conditions, and when someone brought up the subject, he was accused of amplifying the reports. Committees on various occasions tried to look into the air-conditioning situation but received very little if any encouragement from management.

Shouts of "We want windows" were often heard. Some of these were made in jest, of course, but you'd be surprised at the number of people who were serious when they cried for glassed apertures.

At one time it occurred to some that it would have been a good idea to have an old-fashioned machine shop set up in the back yard and compare production records with the main building. The big money would have been on the windowed house. Unfortunately, this experiment was never carried out, and it still awaits the curious scientist to get at the facts.

This discussion is not meant to debunk air-conditioning. It does, however, plead for common sense in using this modern development. A few suggestions may be:

1. For health's sake, it is best for a human being not to spend too much time in an air-conditioned, windowless atmosphere. It is still required of us to spend as much time as possible in the fresh air and sunshine. Science has not yet produced air for human consumption that can be proved to be better or equally as good as the air in the open country.

2. Likewise, science has not yet produced artificial lighting which is better or equally as good as the light you find on a sunshiny day under a shade tree.

3. Management should check carefully to see that the size of the air-conditioning unit is sufficient to take care of that part of the building to be air-conditioned.

4. Management should make the best of indirect lighting, but it must be borne in mind that in some places there are departments sometimes which require a different candlepower. The Inspection Department, for example, finds it difficult to work efficiently under the same kind of light that usually showers upon the Shipping Department.

That air-conditioning is superb for the average machine shop is an undisputed fact, provided you are not including the human element. The average human carcass is still best when exposed to as much fresh air and sunshine and natural light as possible. You have never seen and chances are you will never witness a Jack Dempsey or a Joe Louis or a Charles Paddock training in an air-conditioned building. We are only 10,000 years removed from the Stone Age, and for Science to attempt to bottle up the human body in too much artificiality will result only in stunting its growth and undermining its health.

The shop of the future will be air-conditioned, but the closer that artificial air and that artificial light come to good old Mother Nature's products, the happier and healthier will be those who produce in the shops. Either that, or counterbalance the stay indoors with as much outdoor living as possible.

Val Palmer
Rockford, Ill.

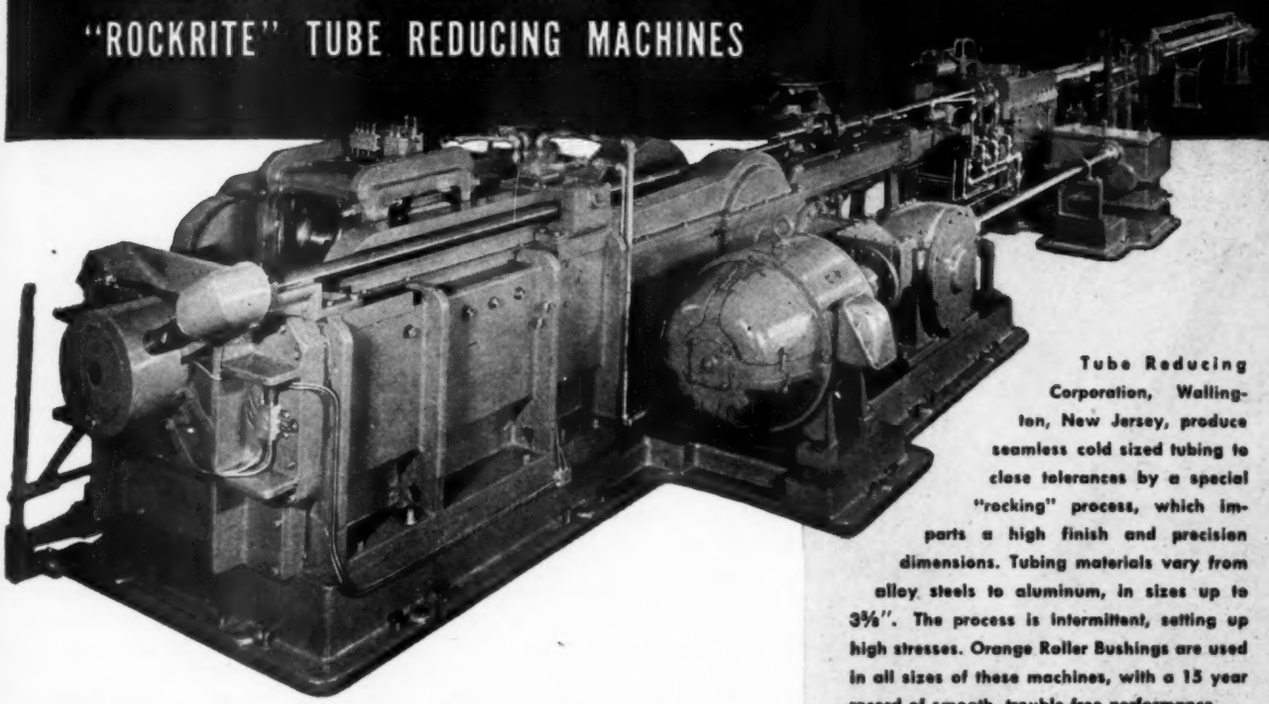
•

Taken by and large, both management and workers should welcome the advent of windowless factories. Psychologically the first reaction from the workers themselves will be strongly against any such innovation.

PRECISION *under* HIGH STRESS!

ORANGE ROLLER BUSHINGS

USED FOR 15 YEARS IN "ROCKRITE" TUBE REDUCING MACHINES

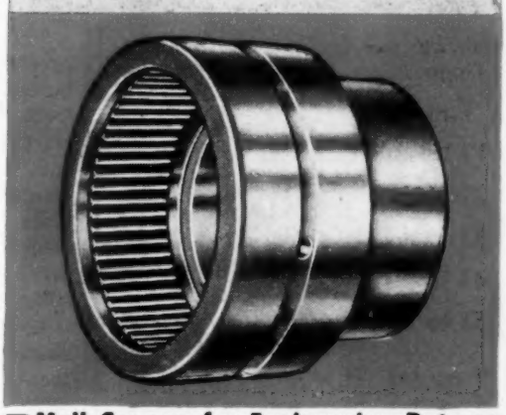


Tube Reducing Corporation, Wallington, New Jersey, produce seamless cold sized tubing to close tolerances by a special "rocking" process, which imparts a high finish and precision dimensions. Tubing materials vary from alloy steels to aluminum, in sizes up to 3⅝". The process is intermittent, setting up high stresses. Orange Roller Bushings are used in all sizes of these machines, with a 15 year record of smooth, trouble-free performance.

ORANGE ROLLER BUSHINGS combine high load carrying capacity with minimum space requirements. Many machine designers have taken this combination into account, and have built Orange Roller Bushings into their products — with very gratifying results. They find that Orange Roller Bushings stand up under repetitive shocks and severe stresses, while retaining their quiet, smooth, cool-running characteristics with complete freedom from trouble. This is why:

Rigid standardization of dimensions permits much closer internal running clearances, maintaining true alignment of rollers with the raceways. Exceptional standards of heat-treating, finishing and assembly are maintained. Ample overload capacity is designed into every unit.

Orange Roller Bushings are made in a full range of types and sizes to meet practically all requirements. When planning new or revised designs, consult our engineering department. The coupon brings a copy of our Engineering Data Book. Send for it.



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This, no doubt, may be divided into two main classes: those who by instinct or experience feel they have witnessed innovations of management fail outright or work to their detriment and will look only for some reason, supposedly obvious to them, that costs are going to be saved by some so-called improvement which is being instituted with no consideration for their welfare. The other class is composed of individuals who are "agin everything." Progressive firms are trying to correct such reasoning by going to the employees and "selling" ideas before inception. The wisdom of this is being proved daily and has even approached the happy point where the "boss" is buying ideas from the shop.

Many factories of recent construction have introduced as much natural light as possible by lowering window sill levels to within a foot or two of the floor. In plants operating three shifts, this benefited only those working days—and let's see what happened there. In an instance where machines and low windows run along a south wall, several things occur:

1. The heat of the sun on warm spring and fall days is too much for the fellow immediately next the window so he opens it and chills off the man in the next section.

2. On extremely cold days he radiates his own body heat towards the window, is everlastingly cold and drives maintenance men wild with requests for more heat, larger units, dodgers to block off the cold, coverings in all probability that shut out some of the desired light that prompted the windowed wall.

3. There have been cases too where precision equipment, such as jigborers, though situated some distance from the windows, have been thrown off calibration by direct rays of the sun. Window coverings of all kinds ranging from fish glue to colored glass, sheets of paper to venetian blinds, are used as a remedy but serve to reduce illumination and possibly ventilation.

4. In the event, through circumstances or poor layout, an operator faces a windowed south wall, eye fatigue from contrast or glare exhausts him and slows down his production.

5. There have been instances where lighting has been installed to aid daytime operations during winter months. Later these processes have been put on 24-hr. shifts but no attempt has been made to check the light values over the work area under zero daylight conditions and management blames the night shift for the resultant lower production figures.

So let's see what happens when the factory is bricked up:

1. The worker has uniform heat, light and air.

2. Maintenance men are spared thinking up cold weather shields, warm weather shades—they are washing no windows, even if they work for one company as did the writer where the plant windows were washed every 12 years, whether they need it or not.

3. Precision machinery operates in a constant temperature on material at "rest" and the operator is neither lethargic from excess heat of summer, radiator proximity or running off for a smoke to get warm.

4. Layout is simplified as there should be no sharp contrasts or glares to induce eye fatigue—no standing in your own light or headstocks facing the wrong way.

5. No birds in the plant.

6. Dust or odor emanations cannot pass in or out.

7. The efficiency of low-velocity dust systems would be considerably increased by the absence of any higher speed wayward gusts that tend to move dust out of the controlled area of this type of exhauster.

8. Since illumination is constant regardless of outside conditions there is no reason for production fluctuations caused by changes in outside light during seasons or day and night.

9. Management must of necessity use the best lighting, painting and air-conditioning engineering in such construction, helping immeasurably the lot of their employees by controlling three factors any one of which they are or have been prone to ignore.

As each one of the above represents an improvement in the situation for the worker, he should, on having them pointed out to him, feel enthusiastic about such a change—management thereby profiting twofold through increased production and reduced maintenance.

A. M. Elliott
LeRoy, N. Y.

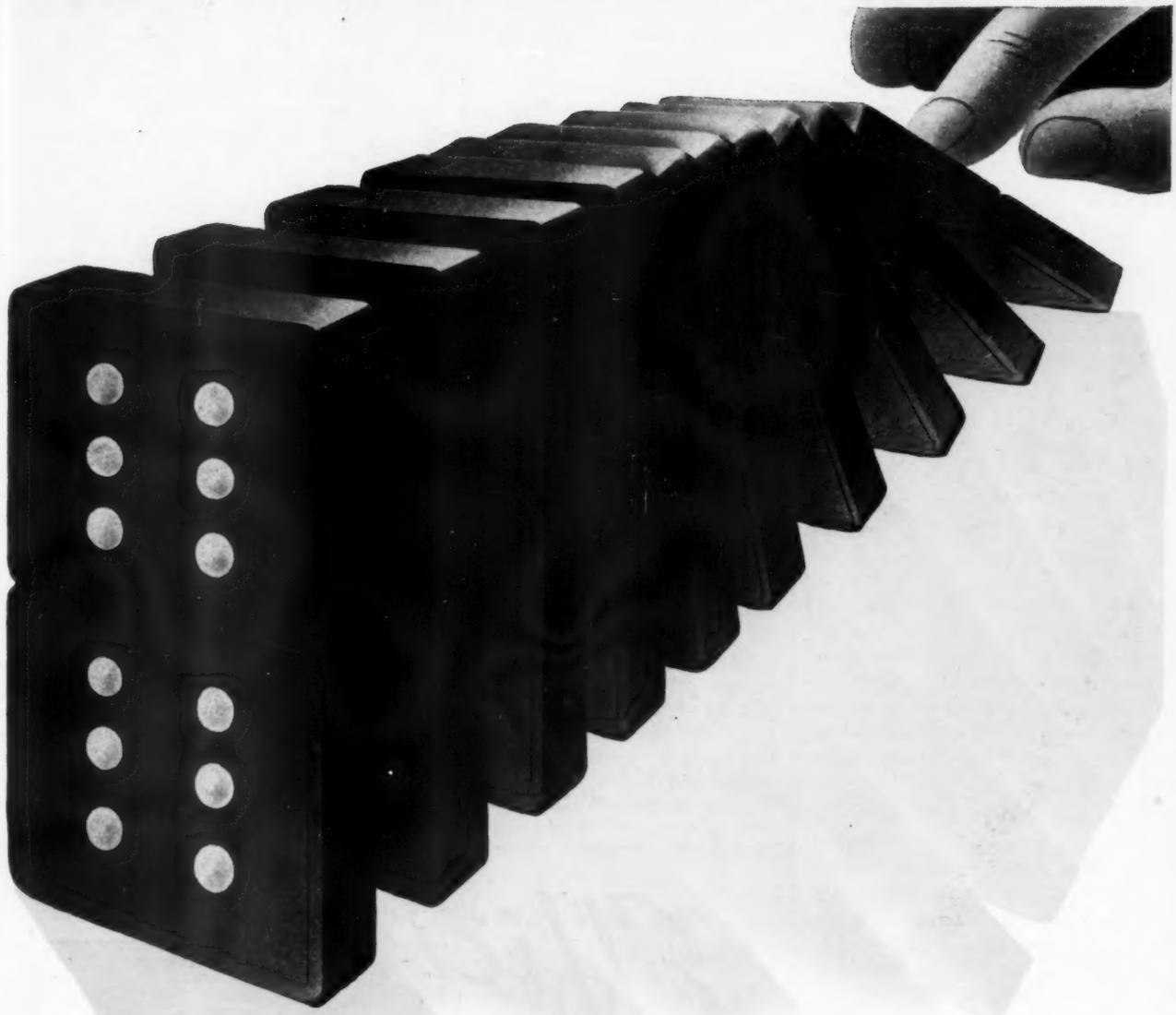
•

YOUR OWN BOSS?

On first thought it would appear that when the owner of a shop devotes his own time to reduce the cost of a job, doing work of an employee whose income is half or less than the owner's, he is saving money on that particular job.

Let's analyze this by the facts as they really are:

Say the owner works an average of



ONE DOWN . . . ALL DOWN

When you hook up a factory-full of machines into one continuous production line . . . a million dollars worth of machines working as one machine . . . and you start it going, IT'S GOT TO GO. Sometimes, as in the textile, paper and paint industries, it's got to keep going for as long as 8000 hours a year. That puts it up to every single machine to keep going because one down, for repairs or maintenance, means all down.

Which puts a lot up to the bearings. That's the reason so many concerns in continuous process industries put their bearing problems up to Fafnir. In the textile industry, for instance, Fafnir designed ball bearing units for sixty or more different types of machines . . . units that slip right in place of hard-to-maintain plain bearings. And such units as the cartridge type ball bearing where completely housed units are needed. When the production runs are long, machines need every bit of the precision manufacturing and testing that Fafnir Ball Bearings get. And they need the Fafnir lubrication seals . . . to keep the lubrication where it's needed and away from products like textiles and paper where a single drop can cause costly spoilage.

Of course it takes more than one or two features to account for the preference of machine designers and users for Fafnir Ball Bearings. It takes the Fafnir way of looking at ball bearings from the machine end of the job. The Fafnir Bearing Company, New Britain, Connecticut.

MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

It takes more than a non-ferrous alloy to make perfect cast-alloy cutting tools. Delloy CA tools owe their higher red-hardness to a new and exclusive casting process. It is the casting "control" that gives Delloy the "edge" over other tools. They are plenty tough.

Users report that they can grind Delloy CA with greater clearance angles than other tools of similar composition. Perfect for those "in-between" jobs that burn up high-speed steel and that chip carbides, Delloy CA is the tool to use when your production problems have you in the "middle."

Meanwhile, don't forget Delloy GP (General Purpose) and Delloy TC (Tungsten Carbide), the other partners of this famous trouble-shooting trio. Together with Delloy CA, they are your best answer for "allmetal" cutting jobs.

Standard tools of all Delloy grades in stock for immediate delivery. Special tools promptly made up to your order. Send us a sample or blueprint for quotation. Your copy of the new Delloy catalog is ready.

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3,000 hr. a year, which is 500 hr. more than a man working 8 hr. per day, six days a week.

Say that the owner's income averaged $7,500 a year. This would make the 3,000-hr. average $2.50 per hr. Now regardless of whether he is making or losing money on a particular job, any time of his own that he takes from his allotted 3,000 hours per year supervising and running his business, is costing him that same $2.50 per hr.

On this basis the only job he could afford to put his time in place of less costly labor would be a job that he is making a good margin of profit on. To put it on a job he is already losing money on would simply add to the loss over a year's business.

Misspent time of the owner on a losing job will be reflected in decreased annual earning in this way:

Suppose he puts 10 of his $2.50 hours on a losing job; this may avoid the shop-labor cost of a $1.50 man for 10 hours, or make a $15 saving on that particular job, but the annual earning of the owner is reduced from $7,500 per year to $7,475, or a loss of $10 caused through misspent time on one particular job.

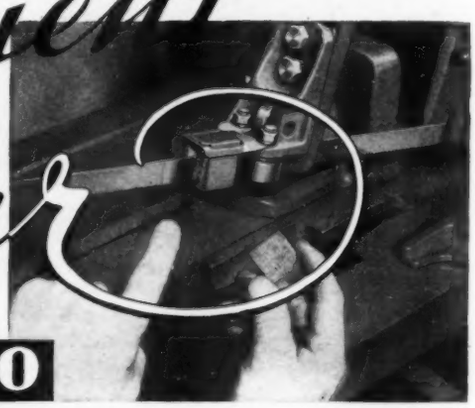
This is sound reasoning and not mere theory. Conservation of more costly time is of first importance in operating any business, and particularly where the owner's hours are concerned, for the temptation to think that by doing minor work and taking time out of a major work allotted hours will not show up in the long run, is a very common and oftentimes a very costly mistaken belief.

The same owner who is thoughtless about his own and higher value hours, would not think of putting a $1.75 an hr. man on a job that could be done equally well by $1.50 an hr. labor, and the reason for this is that he has never properly analyzed his allotted hour-value relationship to his own business.

When he definitely knows that his time is worth $2.50 an hr. or $10 an hr., as the case may be, and this can be definitely proven by his yearly working hours and income. he will be able to see that one misspent hour on any work or job, that can be done equally well by any employee whose cost per hour is less, is a definite loss, and will show up automatically in the annual earning of that particular owner.

Wm. E. Phillips
Blawnox, Pa.

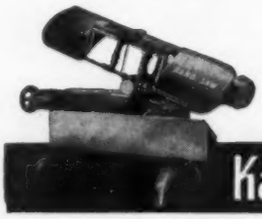
Efficient
SAW TOOTH
Cleaner
with the
KALAMAZOO



Wire brush cleaners of special design remove all chip adhesions both before and after the cut. This contributes to Cleaner, Faster Cutting and Longer Blade Life.

The brushes fit into a special holder and may be reversed or quarter-turned for even wear and to prevent matting. Eliminate faults of stationary or rotating type of brushes that wear unevenly and must be constantly replaced.

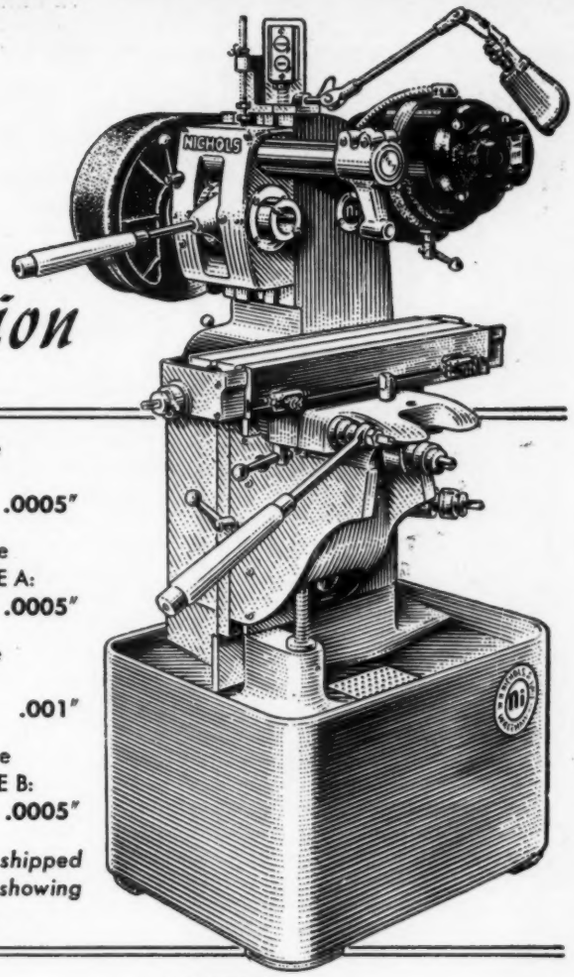
Ask your dealer or write direct for complete information.



MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Co., Kalamazoo 16, Michigan
IN CANADA—BRIDGE MACHINERY CO., MONTREAL

Kalamazoo *Metal Cutting* Band Saw

Puts the PRECISE *in Precision*



Spindle Taper Runout: Allowable Error	.00015″
Spindle Runout on 8″ Mandrel: Allowable Error	.001″ F.I.R.
Parallelism of Spindle to Table: With Error at Spindle Nose	.0000″
Allowable Error 8″ from Spindle Nose	—.0005″
Parallelism of Spindle to Top of Knee: Allowable Error	.001″
Right Angularity of Table to Spindle on 20″ TRAM: Allowable Error	.001″
Squareness of Head Slide to Top of Knee: Allowable Error	.0005″
Parallelism of Head & Knee Slides on Column, PLANE A: Allowable Error	.0005″
Squareness of Head Slide to Top of Saddle: Allowable Error	.001″
Parallelism of Head & Knee Slides on Column, PLANE B: Allowable Error	.0005″

Every Nichols Miller is shipped with an inspection sheet showing these tolerances or better.

Everything about the Nichols Miller has been done to make it as precise as precision can be. Built-in Accuracy . . . Rigidity . . . Speed — all are there ready to give you speed with precision on a single piece or in mass quantity — with Versatility limited only by the imagination of the tool engineer or the capacity of the machine itself.

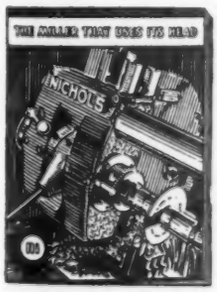
CONDENSED SPECIFICATIONS

Table Working Surface	6¾″ x 21″ or 30″
Longitudinal Travel (screw or lever)	10″ or 19″
Transverse Travel (screw or lever)	7″
Vertical Travel — Knee	13½″
Rise and Fall of Spindle	4½″
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

√ RIGIDITY
Carefully designed, uniform-walled, box-type castings take full advantage of cast iron's strength.

√ VERSATILITY
A "basic" machine easily tooled to handle tool room or production milling within its capacity. Mounting the work in the spindle permits Second Operation boring and facing.

√ SPEED
For example, the Nichols Miller can turn out 1000 cuts an hour on one setup. Then, after a quick tool change, it can be ready for another job.



Send for your free copy of
"The Miller That Uses Its Head"

THE *Nichols* MILLER

MANUFACTURED BY W. H. NICHOLS & SONS, WALTHAM, MASSACHUSETTS

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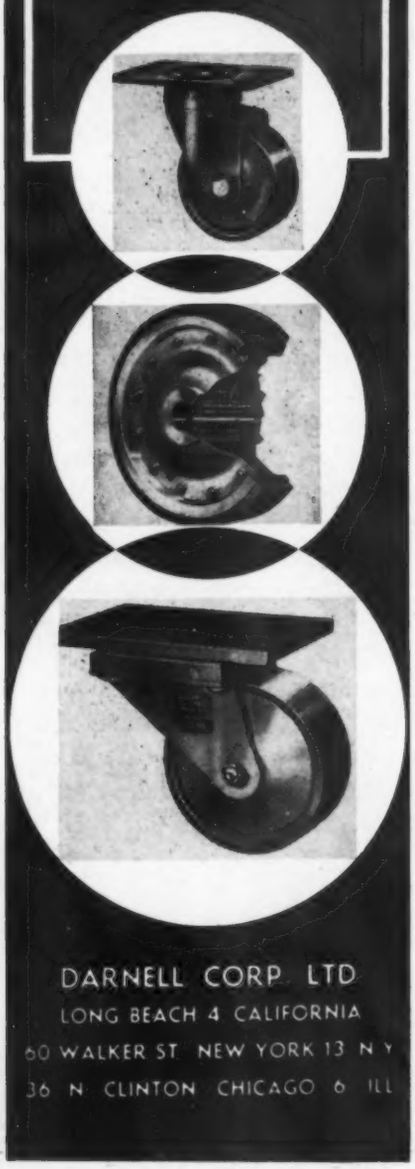
DARNELL CASTERS & E-Z ROLL WHEELS

For Savings, Service Safety and Speed—Demand Darnell Dependability. A caster or wheel for every industrial use.



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NEW BOOKS

SIMPLIFIED PUNCH AND DIEMAKING—*By James Walker, tool and die engineer, and Carl C. Taylor, supervisor of tool construction, Southern Aircraft Corp., 235 pages. Published by the Macmillan Co., 60 Fifth Ave., New York, N. Y. Price $5.00.*

Beginning with fundamentals, this book advances from simple blanking dies to the more complex sectional compound blank and pierce, progressive, and piercing and trimming dies. Kirksite blanking, bending and forming, and drawing dies are also treated. Method of presentation is such that each step in the design, construction and operation is clearly and fully explained with the aid of numerous illustrations. A successful effort has been made to limit the book to modern methods and to eliminate obsolete methods except for comparison purposes. For instance, the section on installation of piercing punches stresses the use of Cerromatrix in anchoring punches in punch plates.

As an example of the problems met in die design and methods of solving them, a complicated yet typical problem is presented—that of tooling for stainless-steel subassemblies of ammunition rolls. A step-by-step solution shows the application of different types of dies. As presented, the book will prove useful as a text in die-making and as a reference for tool engineers and diemakers.

•

EVERYDAY PROBLEMS IN ECONOMICS—*By May Wood-Simons, former instructor of economics, Northwestern University. 544 pages. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill.*

This book presents an extremely understandable explanation of economics and economic principles. Written in textbook fashion, with key points and questions summarized at the end of each chapter, the work should be useful for those wishing to brush up on their economics. In this connection, the dictionary of economic terms should be particularly helpful.

The author has done a yeoman job in simplifying the factors affecting the major aspects of the economy, including production, consumption, the farm and labor problems, prices, exchange, and public finance. Some of the discussion in the chapter, "Democratic Economic Planning," is outdated, since it mentions Nazism as one of the "outstanding types of economic and political systems in the world today," and comments on Great Britain were obviously written before the Socialists came into power.

Some controversial opinions are presented without adequate comment, and there is some minor indulgence in prediction: "We do assume, however, that some means will be found by which every person will have an opportunity to work . . . and in addition that he will have a part in determining policy in industry." If the reader can remain undisturbed by the few such lapses in the book, it is still possible to gain considerable benefit from the work.

•

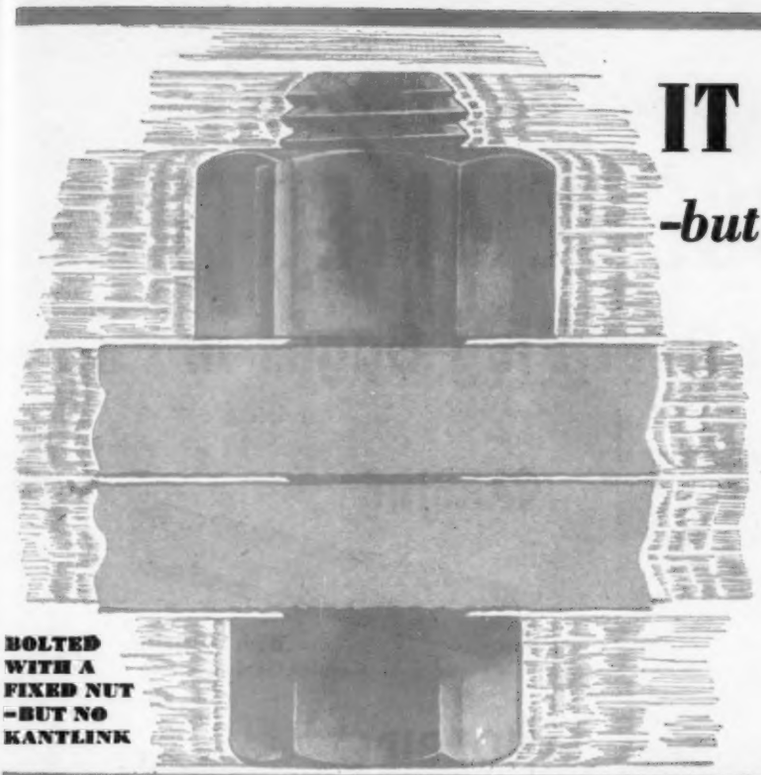
NURSING IN COMMERCE AND INDUSTRY. *By Bethel J. McGrath, R.N. 356 pages, 6 x 9 in. Published by the Commonwealth Fund, 41 East 57th St., New York 22, N. Y. Price $3.*

Prepared for the National Organization for Public Health Nursing, this is really a working guide on the duties and responsibilities of the industrial nurse. As it discusses such related subjects as the nurse's place in the organization, her relationships with officers and employees, necessary physical facilities and functions of the service, hygiene and accident activities, reports and records, workmen's compensation and rehabilitation, it is more than a handbook for nurses. It is helpful as well to the company executive who has, or expects to have responsibility for first aid and nursing activities of his organization. It will also prove useful to the nurse planning to practice her profession in industry or business.

•

MEDICINE IN INDUSTRY. *By Bernhard J. Stern, Ph. D. 223 pages, 6 x 9 in. Published by the Commonwealth Fund, 41 East 57th St., New York 22, N. Y. $1.50.*

This is one of the studies of the N. Y. Academy of Medicine on "Medicine and the Changing Order." It is a monograph covering scientific developments in industrial medicine, social and legislative backgrounds, extent of industrial disability, handicapped workers preventive services, medical care and health insurance and the industrial physician. This is primarily designed for the young doctor selecting a direction for his activities, secondarily for the industrial executive particularly interested in worker-health problems.



BOLTED WITH A FIXED NUT —BUT NO KANTLINK

IT LOOSENED!!!

-but the nut never budged!

Of course it loosened. All bolted assemblies inevitably loosen because of bolt stretch, and frictional wear of metal on metal, burrs, flares or the pulverizing of rust, paint and scale—*when you do not use a spring washer.*

NOW Let's see what happens when you do use spring washers

The nut—fixed or standard type—may never budge a hair's breadth—in fact a nut *can't* budge while there's the slightest pressure on its threads and the threads of the bolt. *But* the other parts of assemblies *always wear loose, except when* a strong spring washer is used to expand as initial wear occurs. The *spring* expands with wear, and holds *all parts tight longer.*

A spring washer is a *must* for *real bolted security.*

There is no substitute. Specify Kantlinks.

Send today for descriptive folders.

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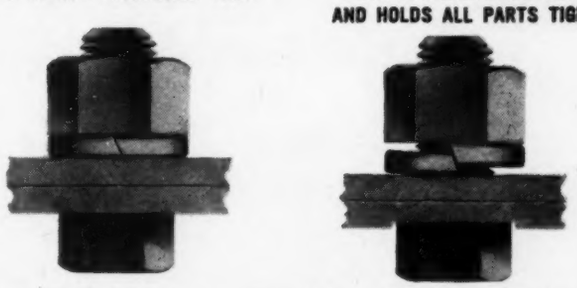
the long-range spring washer

This happens when you use KANTLINKS

BEFORE WEAR
IT'S TIGHT—WRENCHED TIGHT

AFTER WEAR—STILL TIGHT
—THE SPRING EXPANDS
AND HOLDS ALL PARTS TIGHT



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Newark 5, New Jersey — Milwaukee 2, Wisconsin

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Ball-Bearing Pilot Plug Gages in—

*Norbide (Boron Carbide), Trademark of Norton Co., Reg. U.S. Pat. Off.

You can get any degree of hardness you want, in the surfaces of these unique gages which align themselves automatically on ball bearings — and so enter the work *straight*, on their own weight, regardless of the angle of approach.

Availability of Taft-Peirce—Emmerton Gages with super-hard wearing surfaces means *extra* life for these gages which, already, have recorded consistently far longer useful life than standard plugs — because of the distribution of shock and front-end wear over an infinite number of points on the rotating, hardened steel balls in the annular retainer. Single or double-end models, in all sizes from ¼" up. Write:

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SMALL TOOL & GAGE DIVISION
Woonsocket, Rhode Island

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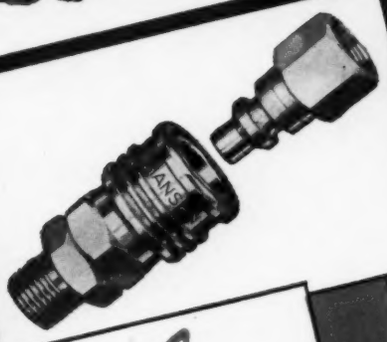
Our engineers, highly specialized, have had years of experience in creating, designing and introducing to industry new and improved equipment which has met with tremendous success, as is evidenced by the users of Hansen equipment. From the largest industrial plants in the world down to the small ones, you will find Hansen equipment widely used. Hansen equipment has proven its worth, particularly in plants where peak production, economy, time and labor savings are essential.

UNION STEMS

HOSE CLAMPS

OXYGEN COUPLING



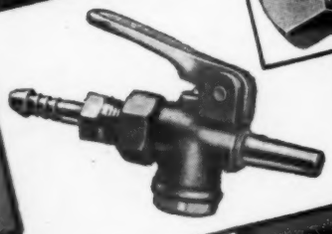
HOSE STEM

GASOLINE COUPLING

PUSH-TITE COUPLING

ACETYLENE COUPLING

& HOSE NIONS



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SWIVEL NUT HOSE CLAMP

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CLEVELAND 14, OHIO

Multi-Section Hole Grinding in One Simple Set-up

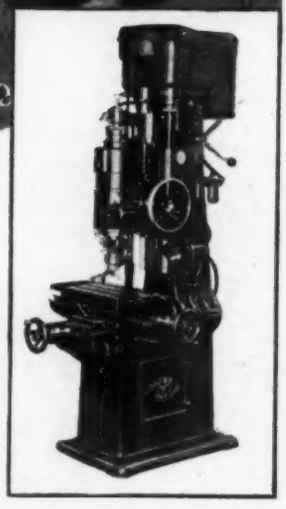
Looking at this 10 station progressive die with 100 holes to be located and ground to .0002" tolerance in the die and stripper inserts, you'd hardly call it a single set-up job. But it is on the Moore Jig Grinder.

On this unique machine *all the sections can be screwed and doweled into place, strapped on the table and ground in one set-up*...eliminating separate section hole grinding and the difficulty of accurately locating each section in the die bed.

Finish-grinds holes within .0001" ...straight or tapered

Hardening distortion is quickly and accurately corrected. The Jig Grinder relocates holes, finish-grinds them—straight or tapered, within .0001"—removes the decarburized surface and produces a smoother finish. All this in *one-third* the time required by previous, more costly methods. And more uniform clearance between punch and die adds from 25% to 100% to the life of a Moore jig-ground die.

You'll want to know more about what this machine can do for you, why it is considered a toolmaker's "must," how the Moore Jig Grinder put die-making on an interchangeable parts and assembly basis. So write today for our technical bulletin.



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New Catalogs, Booklets, Bulletins

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1 TOOL GRINDERS—K. O. Lee Co., Aberdeen, S. Dak. 24-page catalog illustrates and describes tool grinders, fixtures, and accessories. Many illustrations show application of fixtures.

2 HAND SCREW MACHINE—Wade Tool Co., Waltham 54, Mass. 12-page booklet explains Model 5 and 7 machines. Detailed drawings and description of construction and features.

3 SURFACE GRINDER—The Blanchard Machine Co., Cambridge 39, Mass. 15-page booklet No. 242 illustrates, describes, and gives specifications for the No. 11 surface grinder. Several pages explain typical grinding applications.

4 CABINET LATHE—Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. 20-page booklet No. 918L illustrates and describes the 918 plain cabinet lathe. Specifications and detailed descriptions of parts and accessories are included.

5 MILLING MACHINES — Kearney & Trecker Corp., Milwaukee 14, Wis. 48-page catalog E-53 gives concise coverage of entire line of milling machines, boring and milling machines, accessories, and allied products. Tables and line drawings give all specifications.

6 FLEXIBLE SHAFT MACHINES—R. G. Haskins Co., Chicago 12, Ill. 40-page catalog 45 describes full line of direct drive and multi-speed drive machines, attachments, and accessories.

7 PLASTICS EXTRUDERS—National Rubber Machinery Co., Akron 11, Ohio. 8-page folder explains extrusion principle and illustrates with brief description line of extruders and auxiliary equipment.

8 GRINDING AND LAPPING — Norton Co., Worcester 6, Mass. 24-page catalog 1343-5 presents in brief form various types and purposes of machines for grinding and lapping. Large illustrations and concise description of machine functions.

9 PRESS—William F. Brewer Machine Co., Hartford 6, Conn. 4-page leaflet describes Hub power press for punching, stamping, and riveting.

10 ELECTRICAL TOOLS — Bradford Machine Tool Co., Cincinnati 4, Ohio. 8-page catalog illustrates, describes, gives specifications for drills, grinders, and buffer and polishers.

11 ABRASIVE BELT GRINDERS—Hammond Machinery Builders, Inc., Kalamazoo 54, Mich. 8-page bulletin 310 describes three new belt grinders and accessories. Large illustrations and specification tables are included.

12 DRILLS—Canedy-Otto Mfg. Co., Chicago Heights, Ill. 70-page catalog No. 60 illustrates and describes line of bench and floor drills. Cross-section drawings show details of construction.

13 FLEXIBLE SHAFT MACHINES — N. A. Strand & Co., Chicago, Ill. 112-page catalog No. 29 illustrates and describes line of three-speed flexible shaft machines. Includes attachments, tools, and parts.

14 PORTABLE SAW—Mid-States Equipment Corp., Chicago, 49, Ill. 4-page folder describes "Saw Gun" portable power-saw and file. Shows various applications.

15 SPECIAL MACHINERY—Thomas Machine Mfg. Co., Pittsburgh 23, Pa. Catalog covers lathes, dies, jigs and fixtures, steel mill, and other special machinery built to customer's design.

TOOLS AND ACCESSORIES

16 X-RAY UNIT—General Electric X-Ray Corp., Chicago, Ill. 20-page booklet explains and illustrates complete line of flexible X-ray units designed for industrial inspection, with power rate up to one-million volts.

17 AIR DEVICES—Mead Specialties Co., Chicago 41, Ill. 36-page catalog illustrates, describes, and gives specifications for air cylinders, air presses, air vises, and other air devices.

18 DIAMOND WHEELS — The Wickman Corp., Detroit 3, Mich. 20-page booklet explains diamond wheels and hand hones. Cross-section drawings and tables show available wheels.

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19 GUARDS—Strand Mfg. Co., Inc., Chicago 6, Ill. 4-page folder illustrates and describes Strand "Safguard" for protecting operator's hands on press operation.

20 LIVE CENTERS—Sturdimatic Tool Co., Detroit 2, Mich. 4-page folder describes "Engineered" live centers which are made for specific metalworking operations.

21 MILLING CUTTERS—Nelco Tool Co., Inc., Brooklyn 31, N. Y. 4-page folder covers carboloy-tipped face mills and end mills, No. 50 NMTB standard. Includes data on cutter speeds and conversion table for rpm. to sfpm.

22 MARKING EQUIPMENT—Wm. A. Force & Co., Inc., Brooklyn 8, N. Y. 20-page catalog shows line of metal indenting, marking, and numbering machines. Includes type, holders, and other equipment.

HEAT-TREATING AND WELDING

23 WELDERS—The Hobart Bros. Co., Troy 1, Ohio. 48-page booklet "How to Build your Own Gas Driven Welder" takes readers through step-by-step plan with photographs, plans, and ideas.

24 INDUCTION HEATING—Westinghouse Electric Corp., Industrial Electronics Div., Baltimore 3, Md. 36-page booklet describes and gives case histories of applications of induction and dielectric heating.

25 FURNACES—The Lithium Co., Newark 4, N. J. 20-page booklet gives principles and data on Lithium metallic vapor atmosphere furnaces. Question and Answer section sums up booklet.

PLANT SERVICE EQUIPMENT

26 PLATING FILTER—The Udylite Corp., Detroit 11, Mich. 4-page folder describes full automatic filter for plating solutions. Filter has only one control valve.

27 AIR HOIST—Keller Tool Co., Grand Haven, Mich. Bulletin describes light portable air hoists designed for ¼- and ½-ton capacity range.

28 CLEANING—Oakite Products, Inc., New York 6, N. Y. 20-page booklet describes Oakite Tri-San, an industrial cleaning material which cleans, deodorizes, disinfects in a single operation.

29 QUONSET BUILDINGS—Great Lakes Steel Corp., Stran-Steel Div., Detroit 26, Mich. 4-page folder "Space at an Economical Price" describes the 40-ft. arch Quonset building for industrial use. The building comes in single and multiple arches.

PARTS AND MATERIALS

30 VARIABLE SPEED DRIVES—The Master Electric Co., Dayton 1, Ohio. 24-page booklet covers "Speedrangers" showing operation, construction, and application. Many illustrations show flexibility of installation.

31 MOLDED PARTS—Aero-Seal Rubber Products, Div. Chicago Belting Co., Chicago 7, Ill. 32-page booklet explains how mechanical molded parts are made of synthetic rubber and illustrate a number of parts made by the process.

32 TACHOMETERS—Herman H. Sticht Co., Inc., New York 7, N. Y. 4-page folder shows nine types of tachometers including portable and stationery types.

33 VOLTBOX—Superior Electric Co., Bristol, Conn. 4-page folder describes unregulated and regulated Voltboxes for voltage control.

34 TOOL BOXES—Schartow Iron Products Co., Racine, Wis. 12-page folder illustrates, gives dimensions and prices of line of machinist's tool boxes.

35 TOOL STEEL—Jessop Steel Co., Washington, Pa. 12-page booklet "Jessop Steels Cast-to-Shape" describes the line of standard and special shapes. Data is given on the various tool steels which are obtainable in these forms.

36 RINGS—Dresser Mfg. Co., Bradford, Pa. 24-page booklet describes production methods and illustrates many of the types of rings available.

37 LUBRICANT—Brooks Oil Co., Pittsburgh 19, Pa. 8-page booklet describes "I.P." Leadolene, a lubricant of high film strength that repels water and operates at low and high temperatures.

38 COPPER-TIN-ZINC PLATING—Hanson-Van Winkle-Munning Co., Matawan, N. J. 8-page folder gives instructions for bright alloy plating process. Tells what equipment is required, gives operating suggestions, and inspection methods.

39 METAL CLEANING—MacDermid Inc., Waterbury 88, Conn. 1-page data sheet gives operating instructions for Anodex 61-X alkaline electric cleaner for cleaning copper buffed articles prior to plating.

40 BLACK OXIDE FINISH—Mitchel-Bradford Chemical Co., Bridgeport, Conn. 16-page booklet "Black Magic" describes one-bath black-oxide process of treating steel. Process can be applied to gages to indicate wear.

41 BEARINGS—Chrysler Corp., Amplex Div., Detroit 31, Mich. 168-page catalog B-44 explains Oilite process of making bearings and parts and lists standard items.

42 SPEED REDUCERS—The Cleveland Worm & Gear Co., Cleveland, Ohio. 4-page folder describes applications of worm gear speed reducers to various types of mixing and grinding equipment. Each application is discussed, illustrated, and shown on a drawing.

43 PUMPS—Worthington Pump & Machinery Corp., Harrison, N. J. 8-page bulletin W-414-B50 covers automatic Varifio triplex power pumps. Sectional drawings in color show pump operations.

44 PUMPS—Marco Co. Inc., Wilmington 99, Del. 12-page catalog No. 25 describes and gives engineering data on Flow-Master pumps. Sectional and phantom views are included.

MISCELLANEOUS

45 VISUAL EDUCATION—Jordanoff Corp., New York 32, N. Y. 16-page booklet "A Case History" shows how a pictorial analysis was made of a Navy Binocular.

46 BUSINESS TRENDS—Barnes & Reinecke, Chicago 11, Ill. Graph records trends in American business for the past 30 years.

47 MACHINE REBUILDING—Botwinik Brothers of Mass., Inc., Worcester 1, Mass. 20-page booklet shows rebuilding operations and pictures many rebuilt machines.

48 MANUFACTURING—Caterpillar Tractor Co., Peoria 8, Ill. 16-page booklet Form 9355 "Manufacturing Excellence" shows performance records of finished products and manufacturing details which makes them possible. Illustrated are many of the modern machine tools used in Caterpillar production.

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Diameter of Bolt	Actual breaking load	Weight per 100 bolts	Ultimate tensile strength	Material	Heat treatment	No. of threads per in.	Root diameter	Area at root diameter	Length under head
A—3/4"	26,300 lbs.	85 lbs.	75,000 psi	SAE 1020	None	16	0.669 in.	0.351 sq. in.	6 in.
B—3/4"	43,900 lbs.	85 lbs.	125,000 psi	SAE 1035	Quench, draw	16	0.669 in.	0.351 sq. in.	6 in.
C—3/4"	52,600 lbs.	85 lbs.	150,000 psi	SAE 3135 or NE Equivalent	Quench, draw	16	0.669 in.	0.351 sq. in.	6 in.
D—5/8"	30,000 lbs.	58 1/2 lbs.	125,000 psi	SAE 1035	Quench, draw	18	0.553 in.	0.240 sq. in.	6 in.
E—5/8"	36,000 lbs.	58 1/2 lbs.	150,000 psi	SAE 3135 or NE Equivalent	Quench, draw	18	0.553 in.	0.240 sq. in.	6 in.
F—1/2"	18,600 lbs.	37 lbs.	125,000 psi	SAE 1035	Quench, draw	20	0.435 in.	0.149 sq. in.	6 in.
G—1/2"	22,300 lbs.	37 lbs.	150,000 psi	SAE 3135 or NE Equivalent	Quench, draw	20	0.435 in.	0.149 sq. in.	6 in.

IT MAY BE POSSIBLE TO USE A BOLT

—half the weight you've specified!

Can such a cost reduction be made *safely?* Here's *proof* that it can be done.

Look at the table of relative values for three of the bolts shown —each of them ¾ in. diameter by 6 in. length, and then compare them with the two smaller bolts, one ⅝ in. x 6 in. and the other ½ in. x 6 in. In the variation of their physicals lies your opportunity to profit by Lamson engineers' "know-how".

The table shows that you can use a bolt approximately *half the weight and size* of another, and for many applications, obtain all of the essential values you need in your assembly. Or you can continue using the same size bolt, but with higher physicals than you've previously specified—*and use fewer of them.* Bolts in larger and smaller sizes than those shown, made of similar materials, made the same way, properly heat treated, will develop proportionately the same characteristics and physicals as these five bolts shown.

What about the savings you can make by using smaller bolts or by using fewer bolts? First of course is the lower cost per 1000 bolts in a smaller size than you are using. Smaller bolts or fewer bolts *cost less to ship,* require *less storage space,* and need *smaller holes or fewer holes* drilled for their assembly.

Investigate—ask a Lamson engineer to look over your design while it is still on the drawing boards, or let him look over the completed assembly and make his recommendations to you. It's a Lamson engineer's job to "know how".

THE LAMSON & SESSIONS COMPANY, 1971 W. 85th St., Cleveland 2, Ohio

Plants at Cleveland and Kent, Ohio; Chicago and Birmingham

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Please send us ☐ Lamson Blue Book ☐ Bolts, Nuts and Screws ($1.00)
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Send information on ☐ Machine Screws ☐ Lamson Lock Nuts
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Ask your Jobber for the Lamson Line

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Move over, Brothers...

Make room for the newest member of the world's biggest brush family!

THERE'S been a new addition to the world's most famous family of power brushes. It's called the Situft and it's the most amazing little brush you ever saw.

It's built on an entirely new principle of wire suspension and it can do jobs no other brush (in some cases, no other tool!) could ever do before. Its cost is almost unbelievably low—only 17¢ per brush—yet it has saved thousands of dollars in production costs, *cleaning, deburring, and surface finishing internal, hard-to-get-at places.*

It's a worthy addition to Osborn's line of Master Wheels, Monitors, Disc Section Centers, etc.—brushes which have won the plaudits of the industrial world.

A complete tool crib containing one each of 12 sizes (¼" to 1¼") and 2 holders costs only $2.85. Kits and open stock (3 dozen to a box) available from your Osborn distributor.

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

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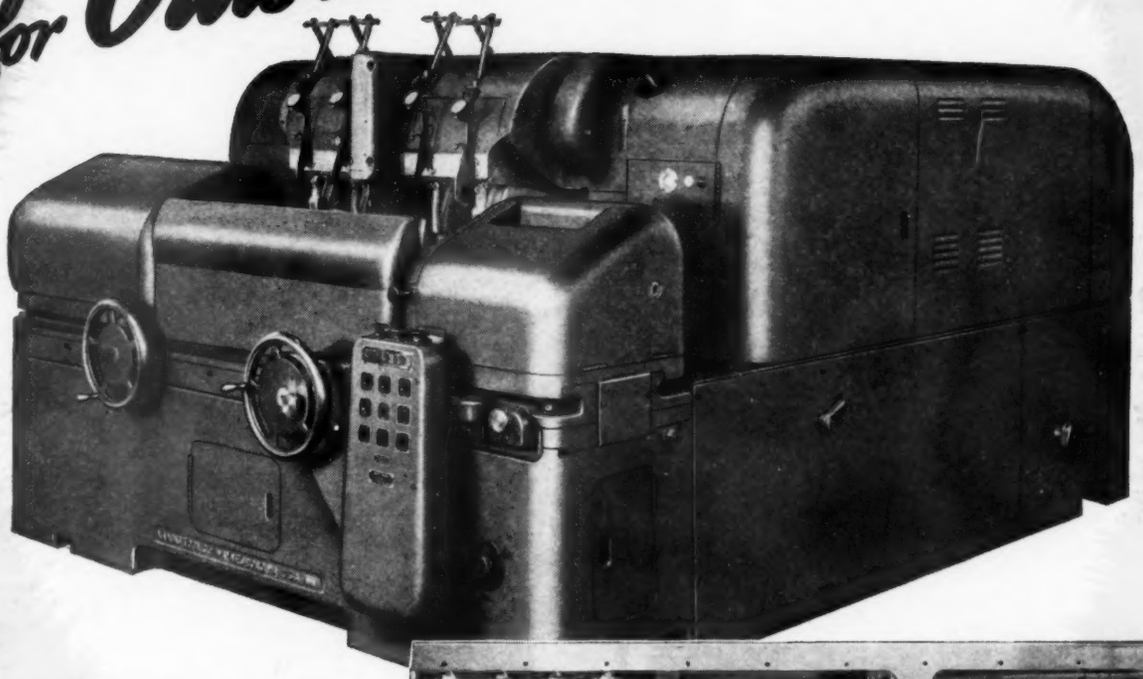
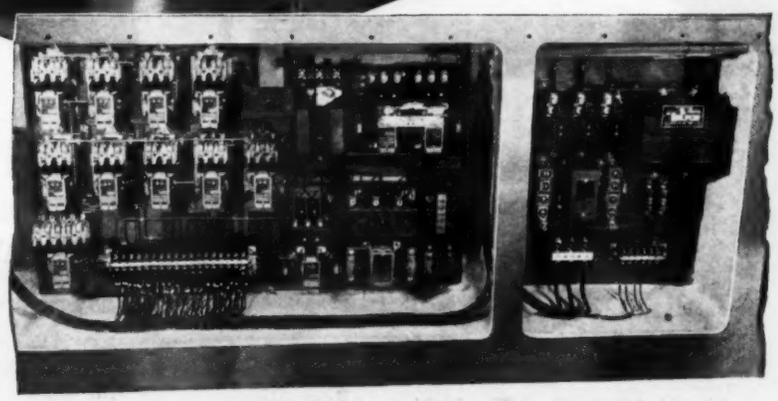
Outstanding Control for Outstanding Machines





Built by LANDIS TOOL for the automotive industry, this 50,500 pound grinding machine provides the fastest known method of grinding crank shaft line bearings. Square D control (at right) puts this machine through its paces by "finger tip" operation.

You'll find SQUARE D CONTROL on machine tools of America's outstanding builders. They value the counsel of Square D Field Engineers and the sound engineering built into an unusually complete line of control units and accessories.

SQUARE D COMPANY

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FOR STRENGTH,
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Mac-its offer a complete line of heat-treated, alloy steel screws for the toughest kind of holding-down jobs. They're accurately made with die-cut threads, and heat-treated for the type of service in which they will be used. Sold through recognized distributors from coast to coast, and in Canada.

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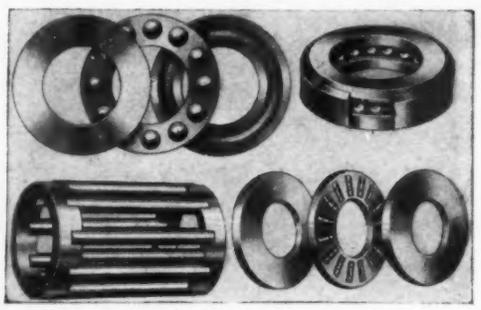

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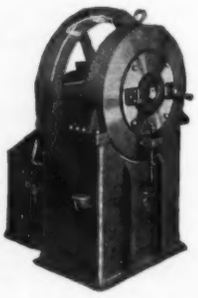

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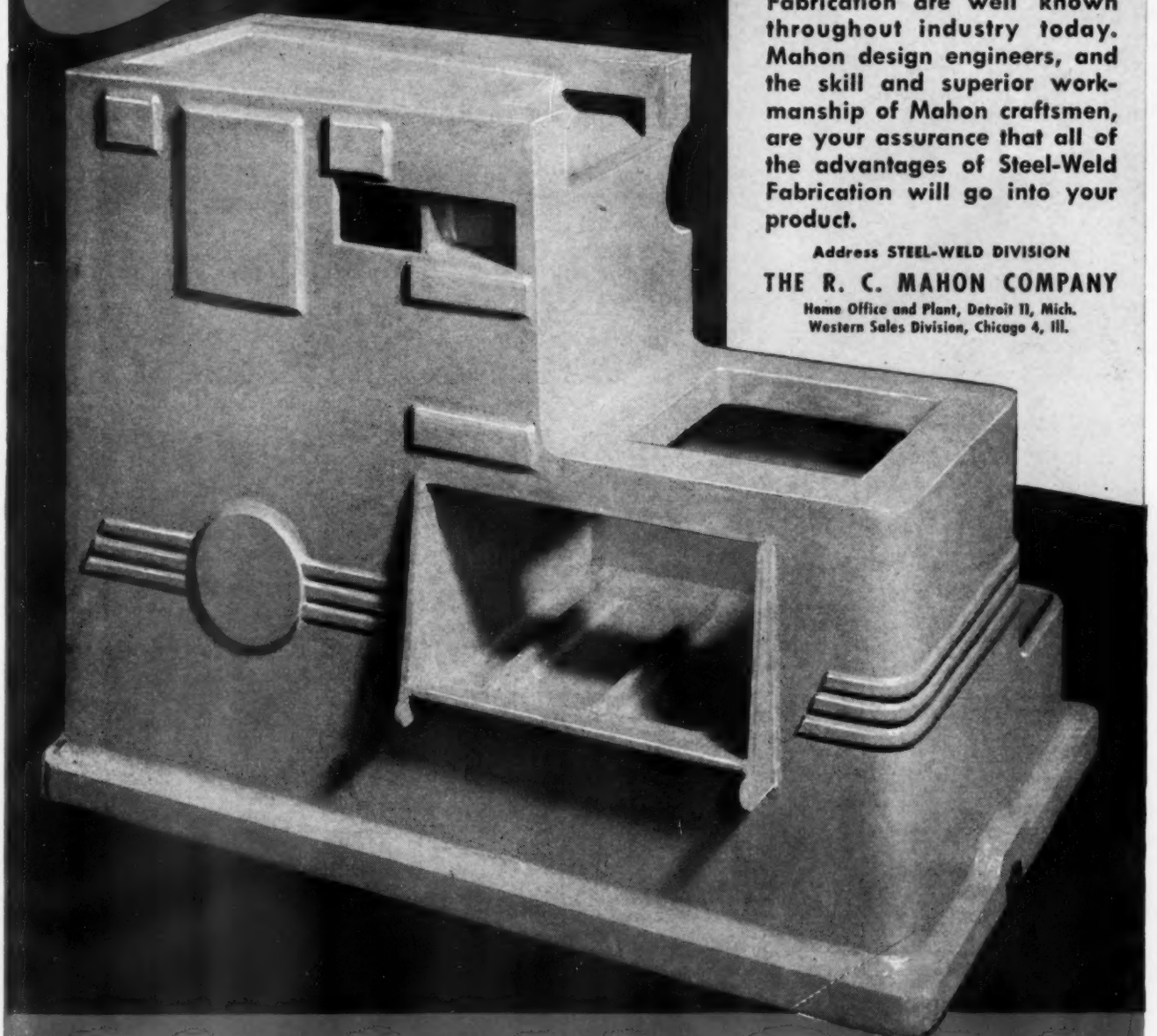

The advantages of Steel-Weld Fabrication are well known throughout industry today. Mahon design engineers, and the skill and superior workmanship of Mahon craftsmen, are your assurance that all of the advantages of Steel-Weld Fabrication will go into your product.

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OUT OUR WAY BY J. R. WILLIAMS

EASY, AL! LEMME GIVE YOU A HAND
THAT'S THE OLD BULL FOR YOU. HE AIN'T GOT TOO BIG THAT HE'S FORGOT HE'S A HUMAN BEIN' AN' LOOK AT MR. SURPRIZE FACE ALONGSIDE O' HIM
YEAH, HE'S GOT HIS LESSON TO LEARN AFORE HE CAN MANAGE LIKE THE OLD BULL HE STILL THINKS IT'S MACHINES MAKES PARTS ...NOT PEOPLE
THE MIDDLE-MAN
J.R.WILLIAMS

The Old Bull Lends A Hand

He may have a million pieces to deliver come a Tuesday—but there's one big thing the Old Bull's not forgetting: he's managing people—*not* metal—he's working with men, machinists, husbands, fathers.

And he's working *for* people—who want better things for better living and jobs to enjoy both. That's why he's in there all the time figuring out new ways and means to better his best.

Helping you meet your assembly costs and keen postwar competition by furnishing close tolerance parts on an economical, mass production basis is our job at Ericsson.

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Let This Automatic Reversing Pump Solve Your Problems

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RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

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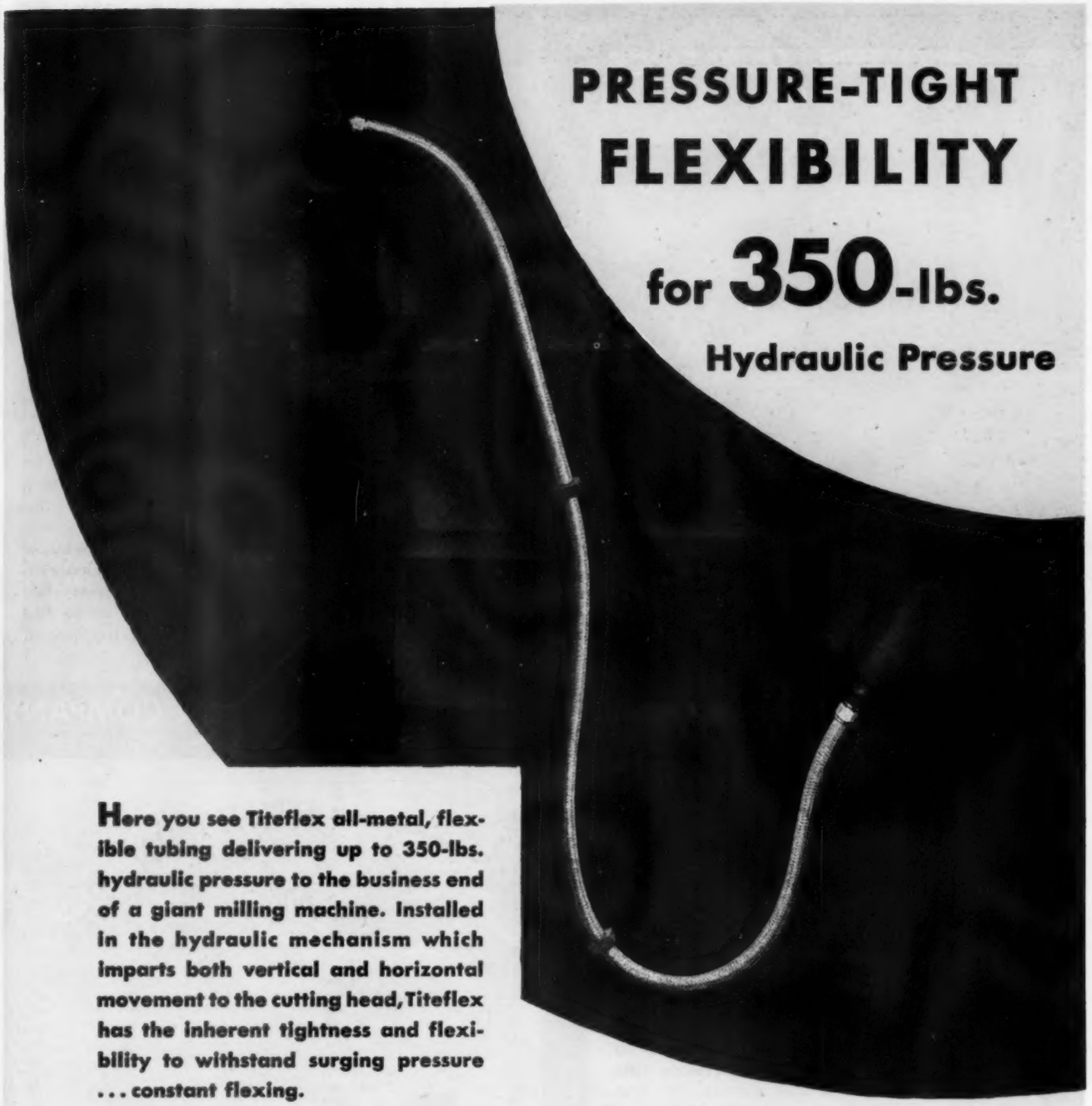

PRESSURE-TIGHT FLEXIBILITY for 350-lbs. Hydraulic Pressure

Here you see Titeflex all-metal, flexible tubing delivering up to 350-lbs. hydraulic pressure to the business end of a giant milling machine. Installed in the hydraulic mechanism which imparts both vertical and horizontal movement to the cutting head, Titeflex has the inherent tightness and flexibility to withstand surging pressure . . . constant flexing.

Similarly, Titeflex gives the same trouble-free performance in no end of applications calling for the conveyance of gases and liquids under extreme temperatures, continued vibration, and corrosive attack.

Investigate now the increased operating efficiency and economies which accrue from the use of Titeflex. Our application engineers stand ready to work with you on any specific installation problem. Titeflex, Inc., 535 Frelinghuysen Avenue, Newark, New Jersey.

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high speed drills
equipped with
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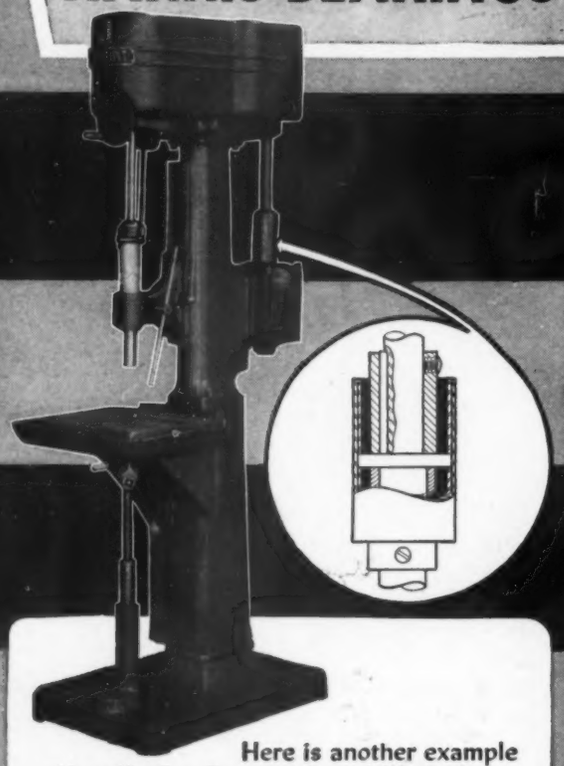

Here is another example of how Torflex Bearings have been successfully used as a coupling in a modern machine tool—in this instance a Foote-Burt Number 2 Sensitive Drill.

In this case Torflex Bearings are used to simplify alignment problems between two shafts and smooth out vibration. The Coupling also eliminates the danger of shaft breakage.

The adaptability and versatility of Torflex Bearings account for their wide acceptance by industry.

Torflex Bearings can be used on all types of machinery, can be made in practically any size, are low in cost and can be readily incorporated in new and existing equipment.

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COMPRESSED RUBBER JOINTS, DUFLEX SHOCK MOUNTS, TORFLEX COUPLINGS.

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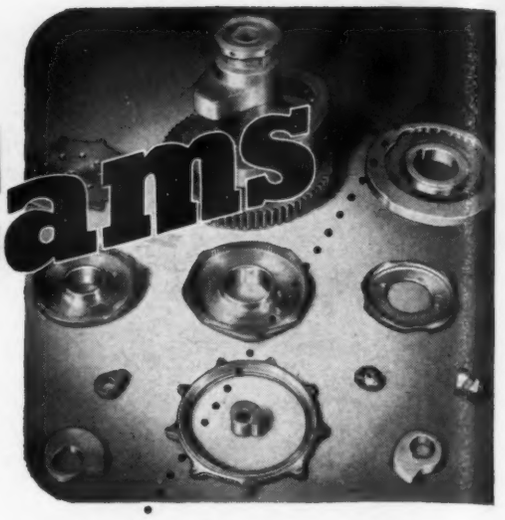

● **25 YEARS** of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, the most complete of any plant in the country, permits us to manufacture any style or size of Cam, Geneva Motion, or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be held to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we will be glad to submit a detailed quotation to you on your requirements.

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Abbott is "right in the swing" of things . . . new equipment . . . more floor space . . . more machines! The nation's all-out production schedule has increased the demand for Abbott Bearing Balls more than ever . . . We're working night and day . . . doing everything we can to meet this demand . . . we're leaving no stone unturned to keep Abbott Bearing Balls rolling to you.

ROLL ON **ABBOTT** *Bearing* **BALLS**
THE ABBOTT BALL COMPANY HARTFORD 10, CONN. U.S.A.

This Rotary Plow Feeder *RUNS ITSELF*

Arrows indicate units of Reliance V★S Drive on Robbins Rotary Plow Feeder at ore-mixing plant of Colorado Fuel and Iron Corporation.

RELIANCE V★S DRIVE

With Reliance V★S Drive

This materials-handling machine works like a robot—moving back and forth all day long at the exact speed required to plow a steady stream of material onto a conveyor belt.

Here is another unusual use of Reliance V★S Drive which demonstrates its amazing versatility. V★S—*the All-electric, Adjustable-speed Drive operating from A-c. Circuits,* provides smooth speed changes over practically an unlimited range, with automatic reversing, starting and stopping. Let a Reliance Engineer show *you* how V★S Drive—rotating or electronic system—can speed up operations and lower costs. Write for Bulletin 311.

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"Motor-Drive is More Than Power"

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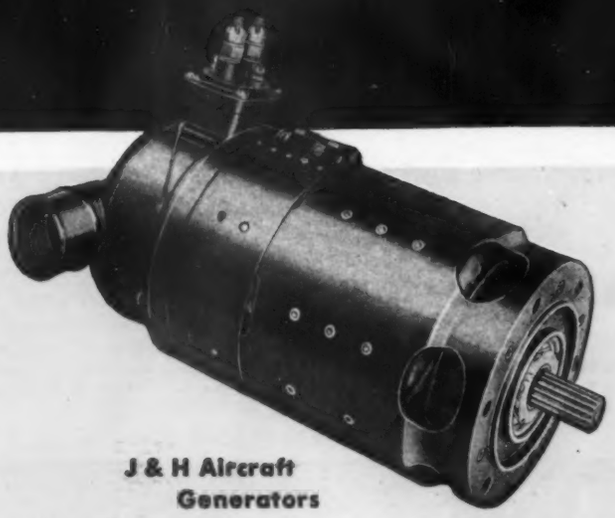
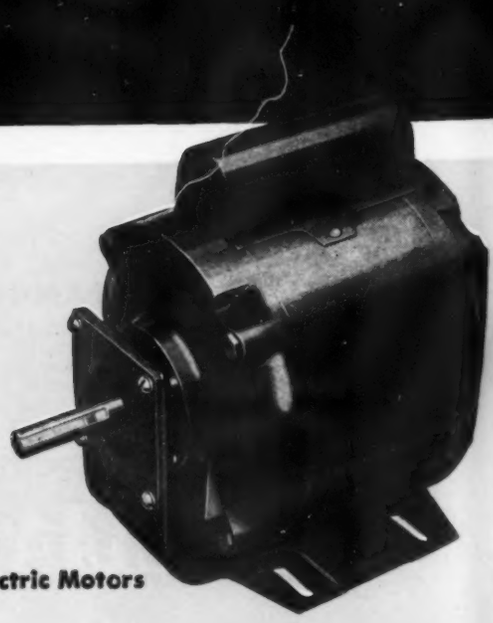


J & H Aircraft
Generators



J & H Fractional
Horsepower Electric Motors

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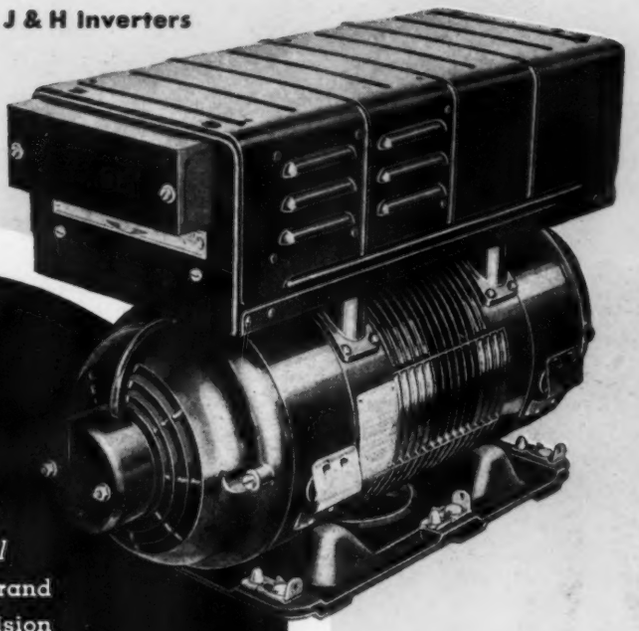
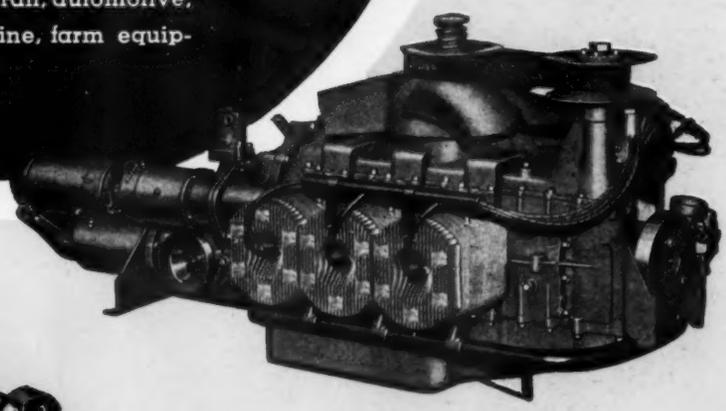


"Precision" is the new word that has been added to our logotype, but *Precision* is not new on our production lines. Our new name had its origin in these production lines where *skill in quantity* and *precision in volume* set brand new standards for the manufacture of high precision production parts.

Yes, the word "Precision" is now in our name. "Precision" is guaranteed by the skilled Jack & Heintz associates on our production lines. And you'll find precision performance in all of these Jack & Heintz products... built precisely for the aircraft, automotive, machine tool, home appliance, marine, farm equipment and transportation industries.

J & H Engines



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JAHCO

Cleveland 1, Ohio

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"I choose alloys like I chose my wife . . .

because a lifetime is a long time!"

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We can help you meet the expectations of your customers and still keep your manufacturing costs in line. Our U·S·S Carilloy specialists make it their business to have at their fingertips the very latest information on the application of alloy steels in every industry. If you want to reduce weight and at the same time increase resistance to wear, fatigue and shock, our metallurgists can show you how the right alloy steel can be applied to accomplish your objective economically.

U·S·S Carilloy Steels represent your most complete source of high quality alloy steels, now available in all grades, finishes and treatments and in the widest range of forms and sizes found anywhere. A letter from you will bring one of our specialists to your plant, ready to put our metallurgical and production facilities at your disposal.

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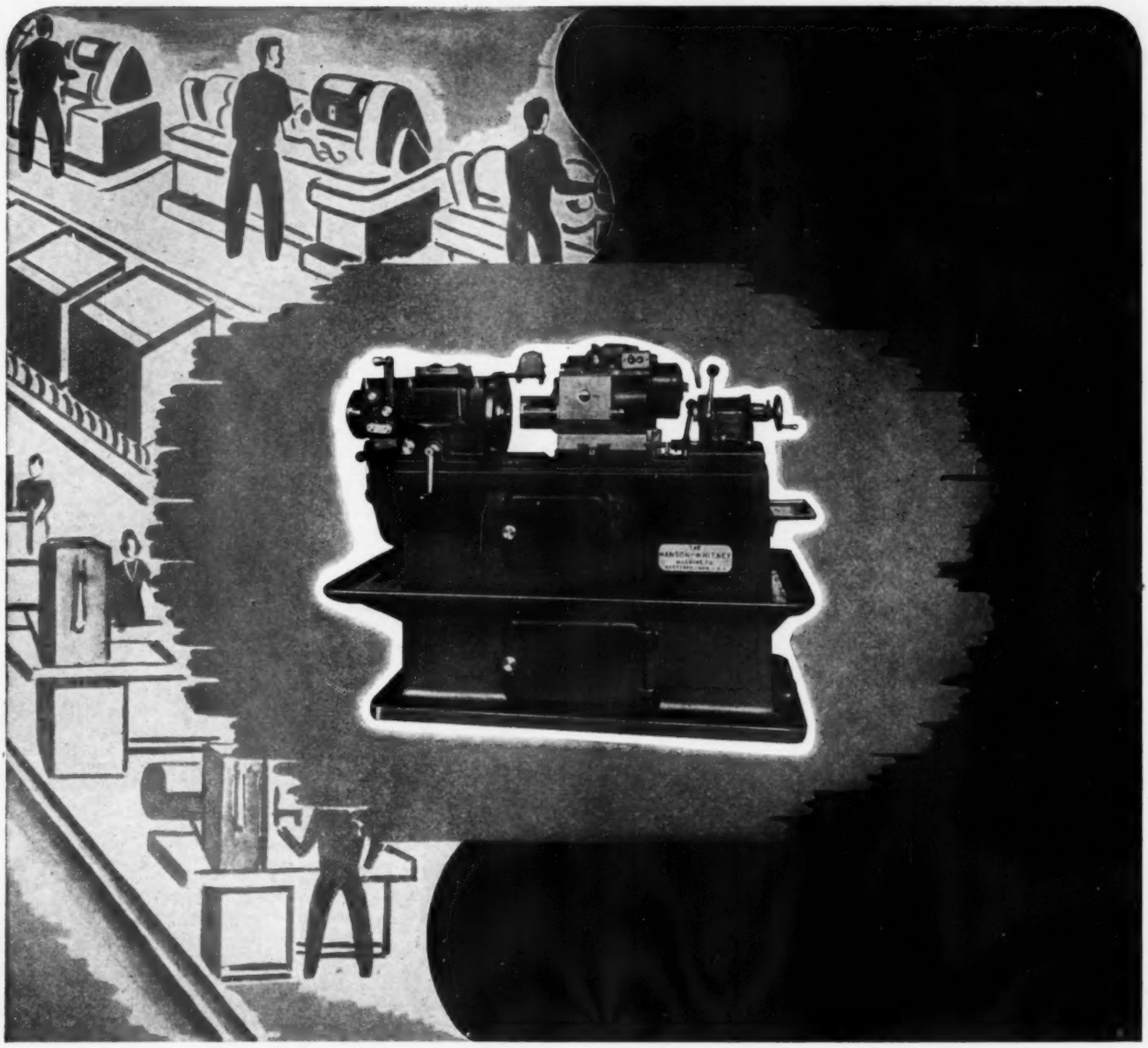

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The Hanson Whitney Semi-Automatic Thread Miller offers the advantages of multiple cutters . . . perfect threads produced at high speed with maximum operating convenience. Saves precious time by producing finished threads . . . internal, external, or tapered, right or left hand . . . with minimum spoilage. Permits working of previously hard-to-thread materials with highest accuracy and precision. Pep-up production with an H-W Miller that is designed to do the job. Write or wire for complete information.

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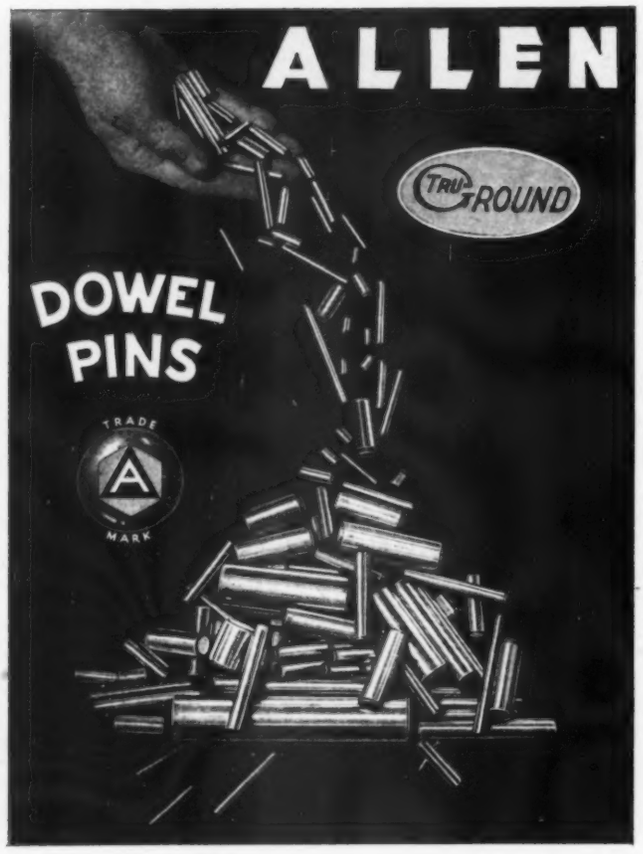
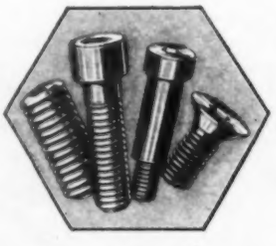


They serve as locating pins for the diemaker's work — and function further as perfect shafts for pins and pivots in various machine assemblies.

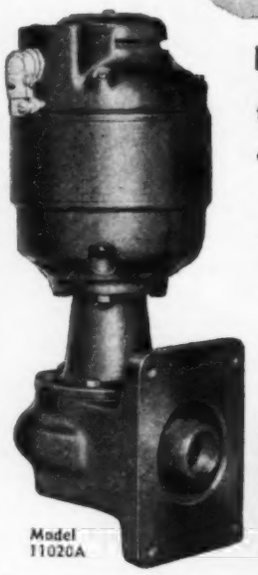
Accurate to a limit of .0002" over basic size, with allowable tolerance of plus or minus .0001". Ground, polished surfaces, treated with rust-preventive. Heat-treated to an extremely hard exterior, with core of the right hardness to prevent "mushrooming" when driven into a tight hole. Tensile strength, 240,000 to 250,000 p. s. i. Steeled to *retain* precision standards in tool and die work; special-analysis ALLENOY steel used exclusively.

Ask your local ALLEN Distributor for samples and dimensional data . . . the same Distributor who serves you dependably with Allen Hex Socket Screws and other first-call mill supply items.



THE ALLEN MFG. COMPANY
HARTFORD, ★ ALLEN ★ CONN.

Dispose of coolant worries when you specify



RUTHMAN
GUSHER
COOLANT PUMPS

You can go far to eliminate coolant troubles when you specify Ruthman Gusher Coolant Pumps for your machine. Simple in design with fewer parts, efficient in operation at moderate cost, they contain many patented features unobtainable on anything but a Ruthman Gusher Coolant Pump.

So, the next time you order metal cutting machinery or replacement units, specify Ruthman Gusher Coolant Pumps.

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The "GUSHER"—A Modern Pump For Modern Machine Tools

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By producing on ferrous rods and wire a non-hygroscopic, ductile, crystalline coating, the Oakite CrysCoat Process adsorbs and retains die lubricants. In addition, the Oakite CrysCoat Process combines chemically with surfaces treated to provide *additional* lubrication.

Among the proved advantages resulting from the use of the Oakite CrysCoat Process are increased production through less frequent changing of dies, longer die life, uniformly excellent wire appearance, shorter downtime of equipment. Complete details gladly sent on letterhead request. Send TODAY!

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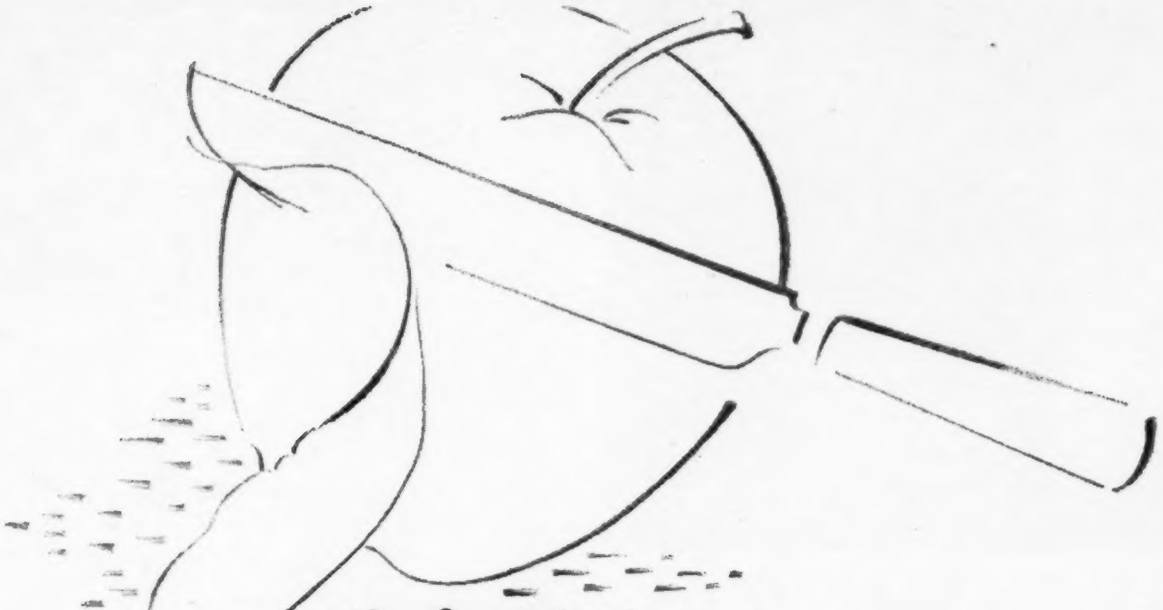

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THEIR "Beauty" BEGINS RIGHT UNDER THE SKIN

They are solid and close-grained immediately under the surface. You will get more usable metal per pound of rough casting and save machining time with only a little "skin" to cut through.

This is the result of uniformity which N-B-M Bronze Parts owe to our mechanically controlled alloying and casting methods.

SAVE WASTE AND TIME...SPECIFY

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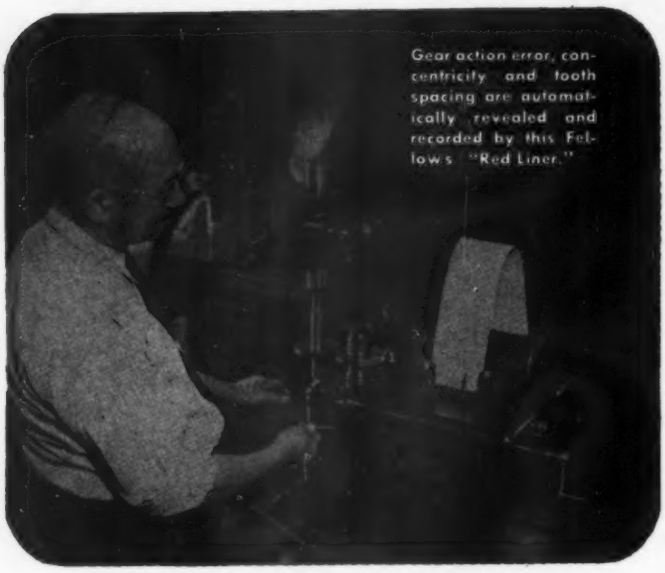

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Sier-Bath Gears are held to a minimum T.A.E. (Total Accumulated Error). Exceptional accuracy is maintained by ultra-modern fabricating methods, designed to give the machinery user the ultimate in end-use economy. Replacing commercial gears with Sier-Bath Precision Gears of the SAME MATERIAL makes it practicable to carry more h.p. load at increased speeds. Longer gear life, quieter operation and maximum continuous service are other advantages. Let Sier-Bath quote on your job today.

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Spur, helical and worm gears to 48"; worms to 12"; straight tooth bevel gears 24 pitch to 3 pitch.

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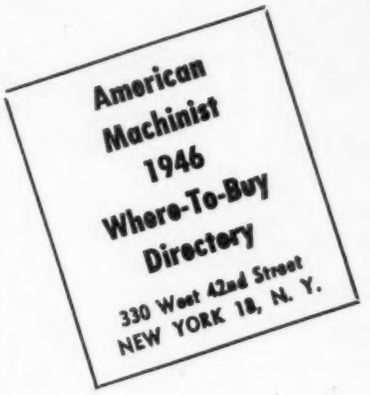

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...at every step FOR YOUR PROTECTION

Regardless of size, type or quantity, *all gears* made by "Phillie" are subjected to the same unrelenting "checking and double checking,"—for as our Founder wisely said many years ago: "Gears that aren't absolutely correct, are as useless as no gears at all."

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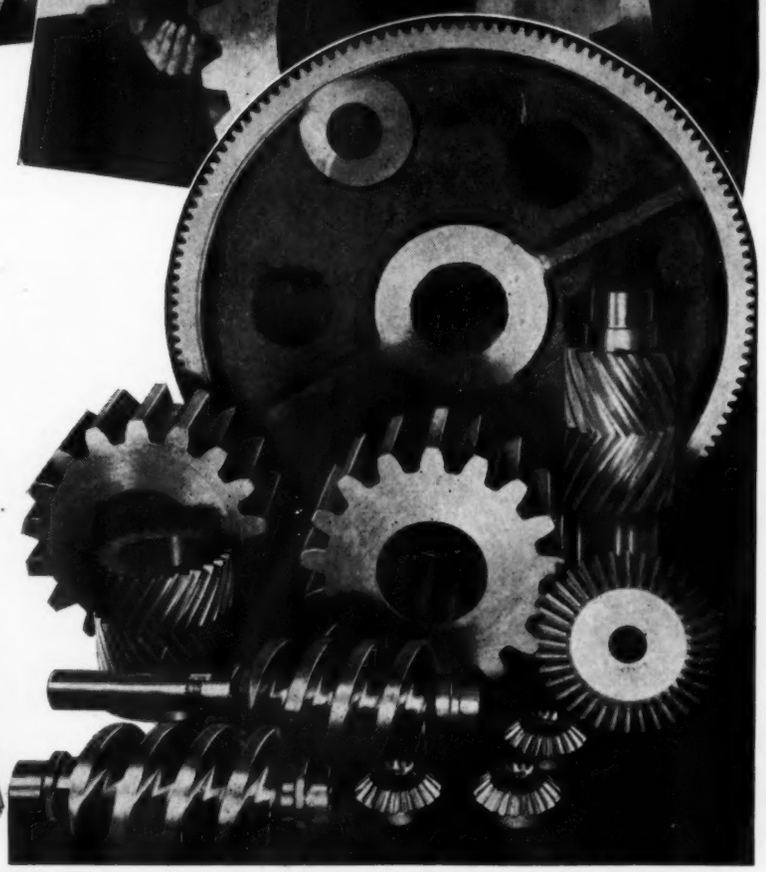

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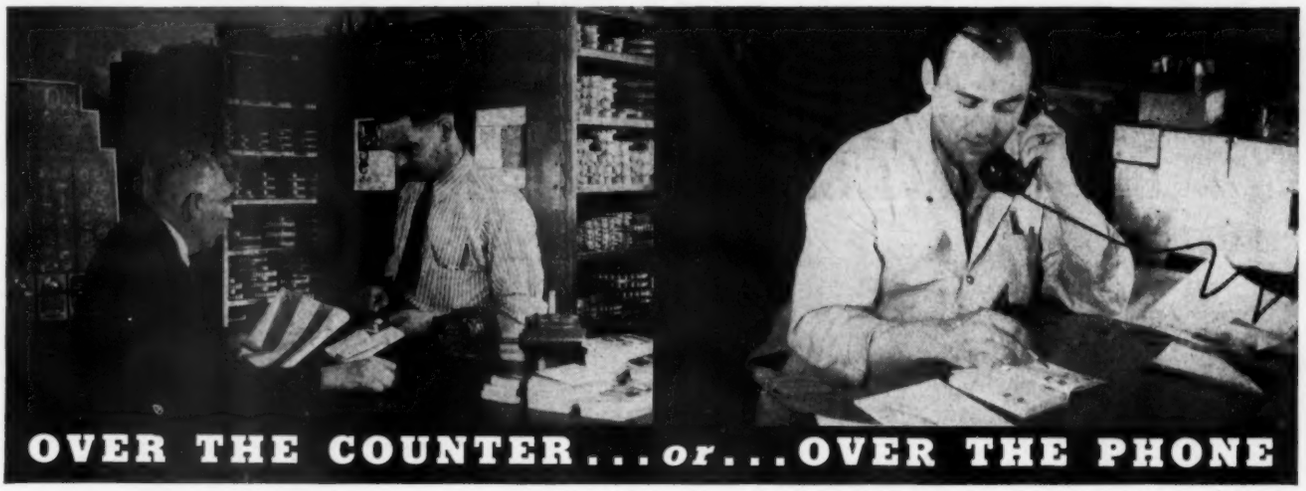

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GEARS • CAMS
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. . . TO YOUR SPECIFICATIONS
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Send specifications—ask for quotations.
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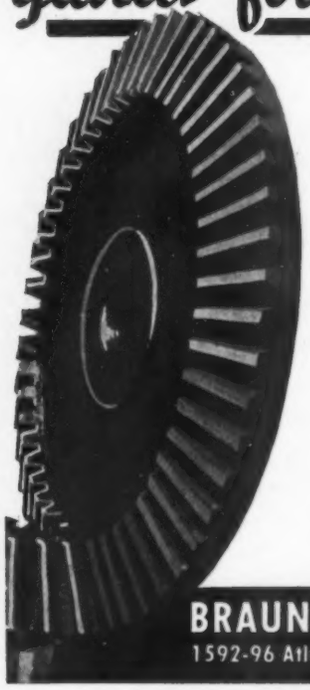

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The modern, efficient Braun Plant produces gears at prices that please buyers. Specify Braun Gears for machines you build. Order Braun Gears when making replacements in production and plant equipment. Gears in all sizes, all quantities and all materials.

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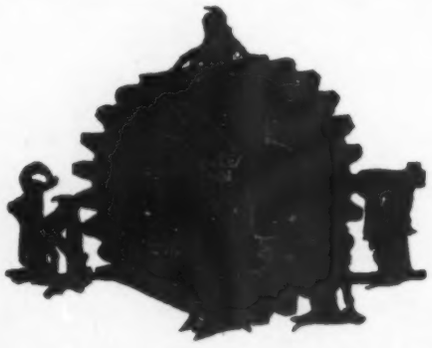

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GANSCHOW

CUT ALL GEARS TYPES

GANSCHOW GEAR CO., 14 N. Morgan Street, CHICAGO 7.

with OHIO STOCK GEARS

The other day we received an order from one of our customers specifing immediate delivery on certain gears. Checking back we found the unit also required motors so we inquired, "When can you get delivery on the motors?" "Oh", replied the customer, "we ordered the motors eight months ago!"

The Ohio Stock Gear situation has improved, substantially, but quantities are limited and deliveries of certain types are not nearly as early as we'd like them to be.

So, just as a suggestion, it might be advisable to plan, *and place*, gear needs at the earliest point possible in your production plans. It's one way of making sure you have the gears when you need them.

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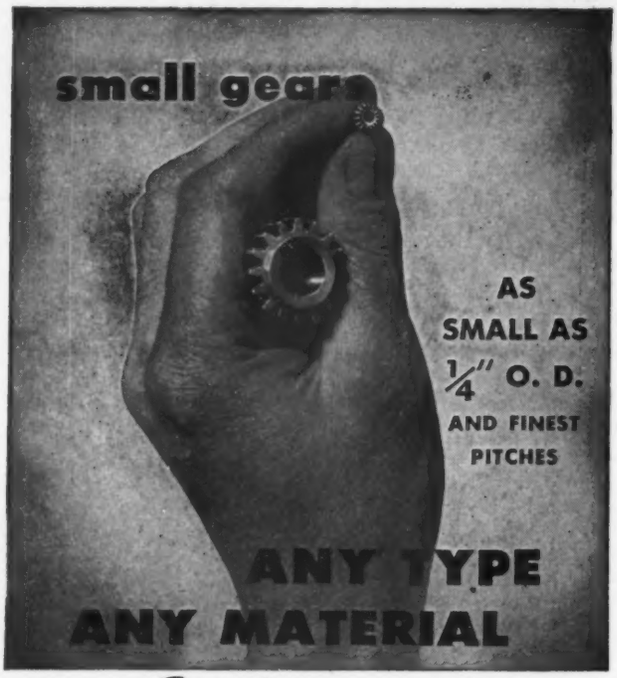

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DETROIT *Bevel Gear* COMPANY

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GOOD GEARS

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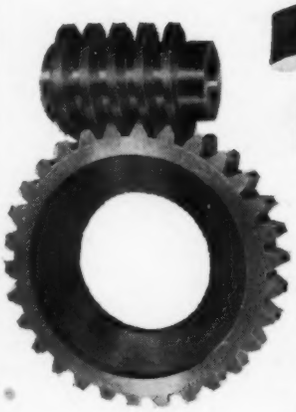

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Each Cincinnati Gear is made to your specifications to meet your particular requirements. For those really important jobs where performance counts . . . insist on the right gear for each job . . . get Cincinnati Gears.

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"Gears . . . Good Gears Only"

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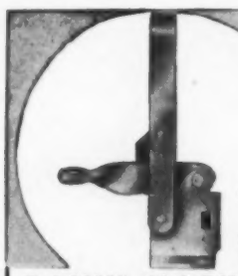

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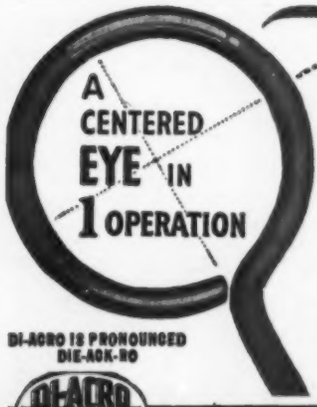

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Precision **CENTERED EYE** *Bending*

With DI-ACRO Benders

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at high hourly production rates. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

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DI-ACRO Precision Bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

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Type — Flywheel at Rear

This press has ample speed, less deflection, less crankshaft distortion, featuring a bronze brake which has an exceptional value in Punch Press construction.

The Clutch mechanism can be set for positive single stroke or continuous.

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The Press is mounted on a steel table of a pan type, rigid, and having facilities for separating the work on each side of the Press. A convenient chute is built into the table to direct the finished work into a container.

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Also a new line of AUTOMATIC FEEDS (feeding the stock to Punch Presses)

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Presents The

COLUMN PRESS

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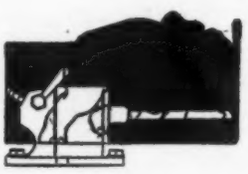

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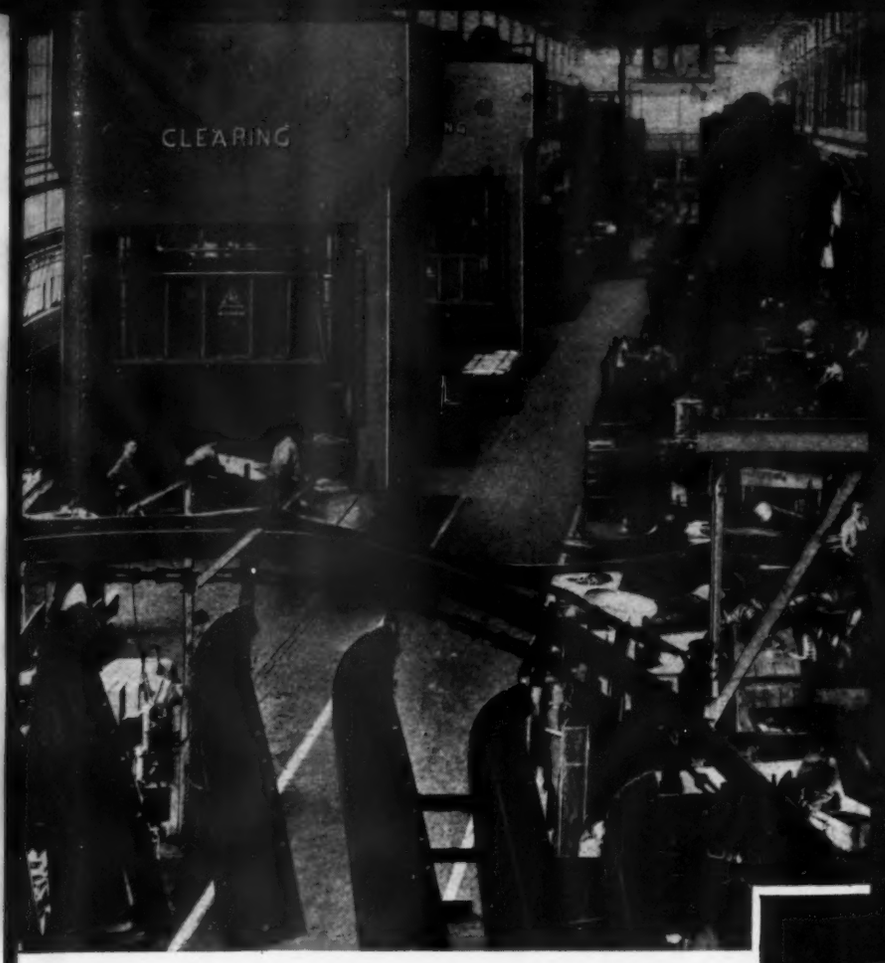

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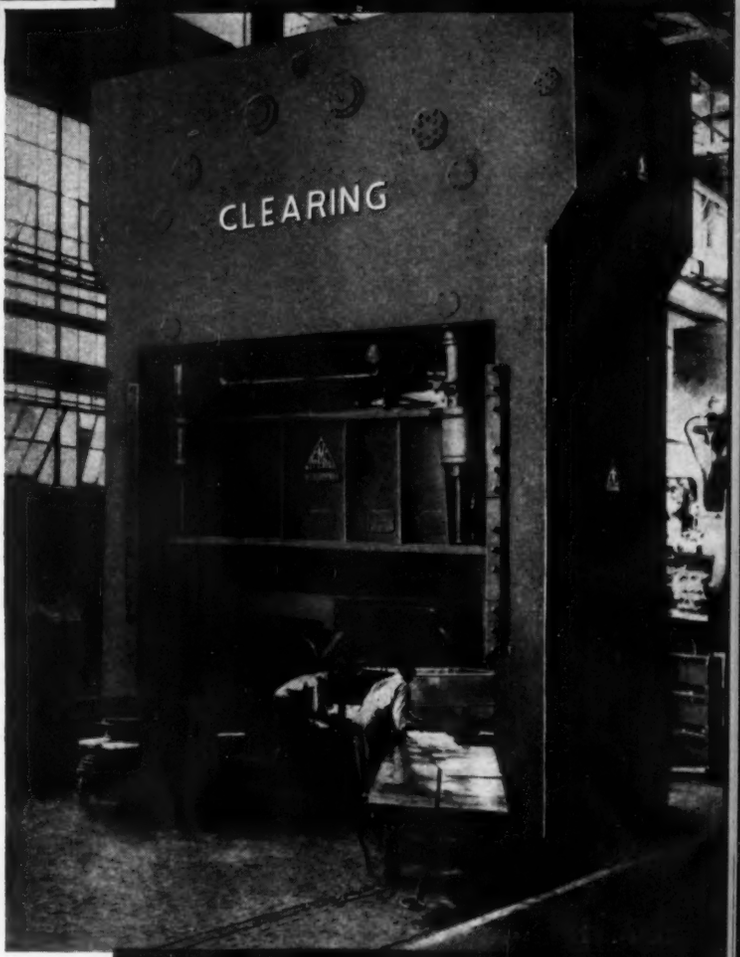
Clearing Press Precision for hard-to-work metals

To work materials like stainless steel, Clearing Presses provide the two essentials for successful operation: (1) Smooth flow of power to the slide and (2) proper suspension of the slide to maintain exact alignment of dies under all conditions. The double-action, 1200 ton capacity Clearing Mechanical Presses illustrated here are used for a variety of jobs in drawing and blanking stainless steel. This has included such relatively large parts as drawn and formed sections for bus and diesel truck fuel tanks and locomotive water tanks.

Clearing mechanical press features such as eccentric drive, double guided slide, air clutch and brake assembly, and welded steel construction combine to give unusual press rigidity, extreme smoothness in power transmission and accurate maintenance of die alignment.

Clearing engineers will be happy to analyze your requirements in press equipment at any time. Clearing Presses, either mechanical or hydraulic, can be supplied in any size or type for every production demand.



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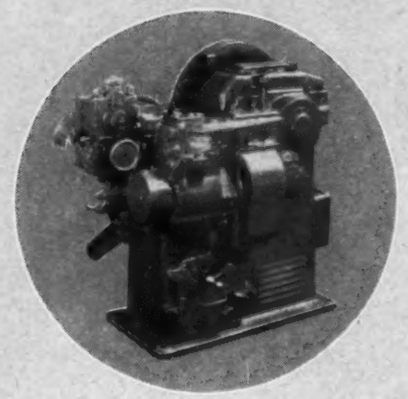
for FORMING . DRAWING . BLANKING . FORGING

also Pneumatic and Hydropneumatic Die Cushions . Automatic Feeds . Accumulator System



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The National Cold Header was introduced only a few years ago.

It is now accepted as the leader of its field.

Extreme simplicity of design is one of the major reasons.

Investigate and you will discover many more.

NATIONAL
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Logan **A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES**

at these 39 points* this *Logan* cabinet turret lathe has self-lubricating bronze bearings

LOCATION	NO. BEARINGS
Underneath Drive	8
Reverse Gear Bracket	2
Gear Box	10
Headstock	7
Automatic Apron	6
Carriage Assembly	4
Turret Assembly	2
*TOTAL	39

*All models of Logan Lathes are similarly protected.

SELF-LUBRICATING BRONZE BEARINGS

KEEP LOGAN LATHES READY TO RUN,

ADD TO SERVICE LIFE,

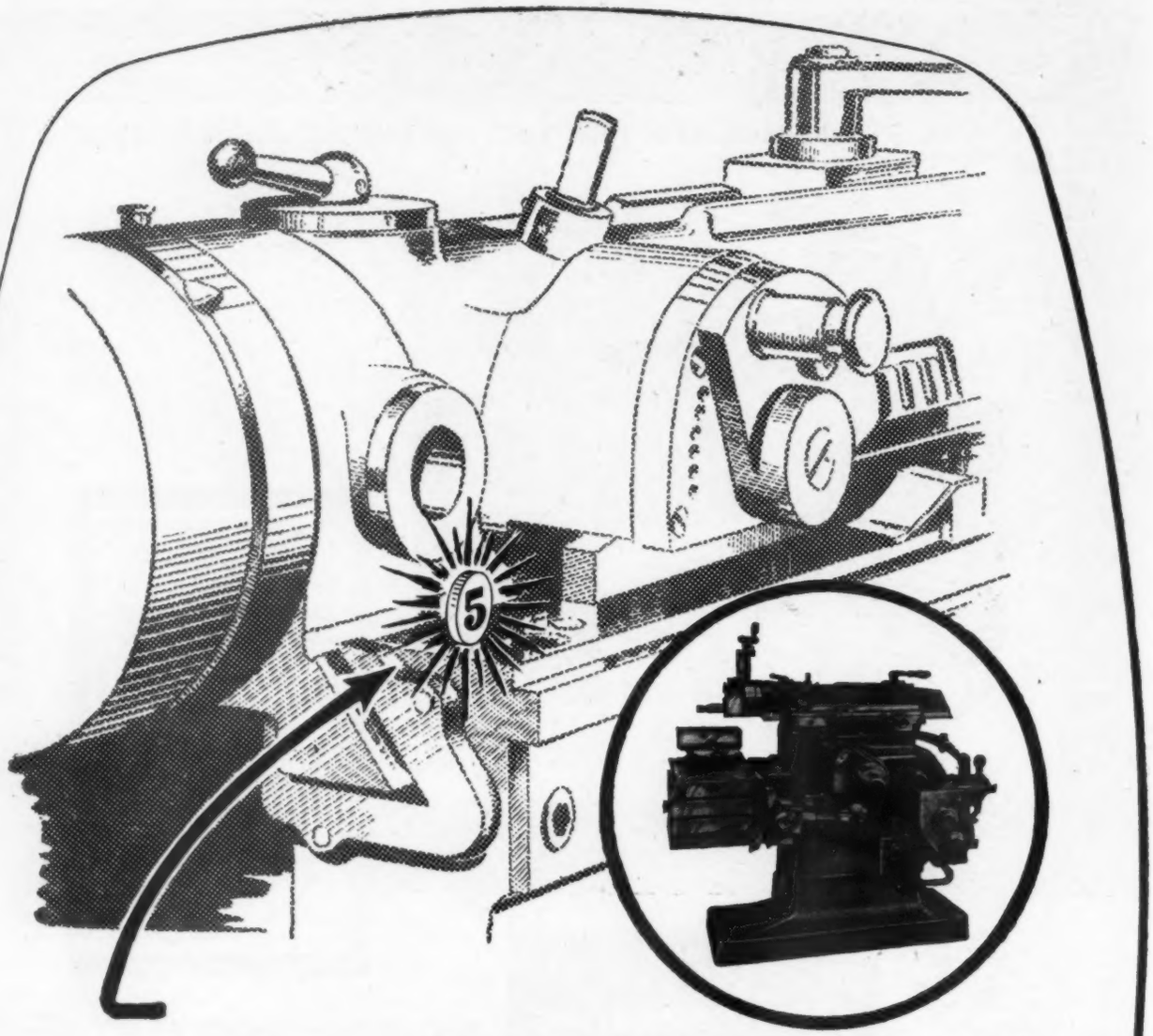
NEED FAR LESS OILING

The use of self-lubricating bronze bearings in place of plain bearings is typical of Logan Lathe design. The self-lubricating bearings are of a special bronze that is absorbent in texture and impregnated with lubricant. As a shaft revolves in one of these bearings, the lubricant is gradually released in a self-controlled flow which keeps an even film of oil over contacting surfaces. In this way, even though the lubricant is only infrequently renewed, the bearing surfaces are protected. In addition, the spindle on every Logan Lathe revolves on precision preloaded ball bearings that never need lubrication. This sustained lubrication is another factor in the sustained accuracy and long life of Logan Lathes. Get the full story of the advantages offered by the complete line of Logan Lathes from your nearby Logan Lathe dealer, or write direct for a catalog.

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½". . . bed length, 43⅛". . . size of hole through spindle, 25/32". . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision-ground ways, 2 V-ways and 2 flat-ways.

J-1

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS



How to keep your nickels from rolling away . . . .

Ever see this stunt? Stand a nickel on edge next to the Hendey 12" Shaper Ram . . . *it stays there even when the machine is running at 200 strokes per minute!* This is further proof that Hendey Shapers "keep your nickels from rolling away", because you can ask any Hendey user about the economies inherent in the Hendey Shaper. He will tell you that they remove metal faster, more accurately, at lower cost than competitive equipment. He will tell you that they are as smooth as velvet regardless of length or speed of stroke.

Nickels are important to your costs. You can start saving them today by writing for the Hendey 12" Shaper Catalog.

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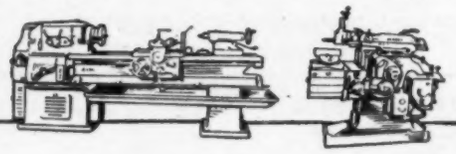
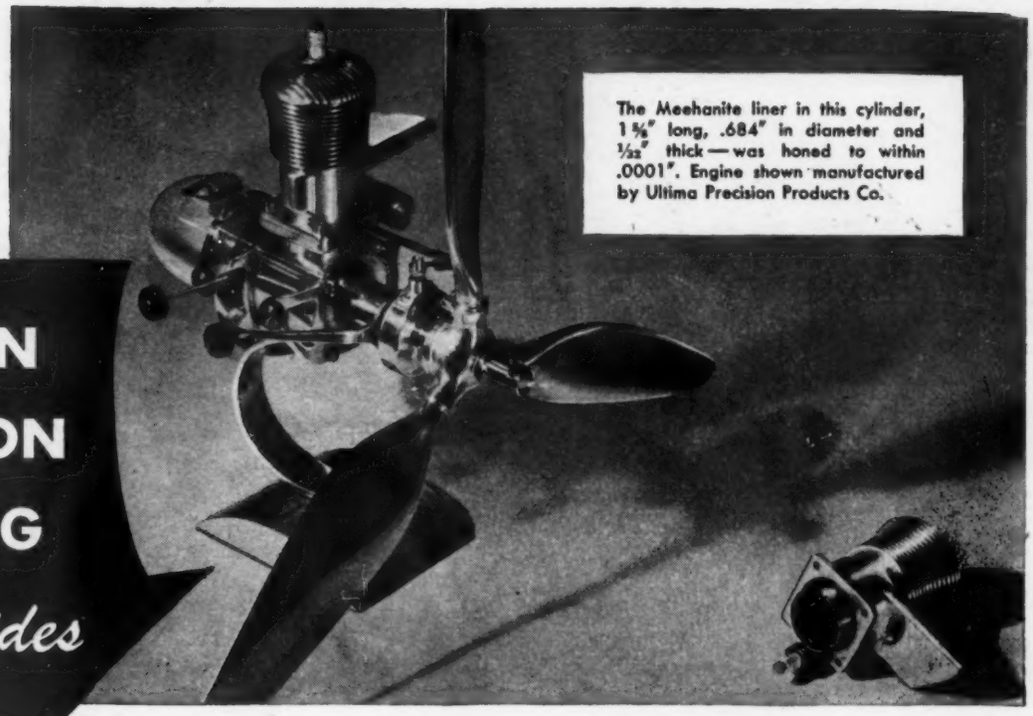


TOOL ROOM LATHES
12"-14"-16"-18"-20"-24"

SHAPERS
12"-16"-20"



The Meehanite liner in this cylinder, 1 5/8" long, .684" in diameter and 1/32" thick — was honed to within .0001". Engine shown manufactured by Ultima Precision Products Co.

SUNNEN PRECISION HONING *Provides*

These ADVANTAGES

for Miniature Airplane Engines

1 ***Long Service Life*** — provided by a perfectly smooth cylinder wall, that is straight and round within .0001".

2 ***Easy Starting,*** even on pen light batteries — because friction is held to a minimum, allowing piston to glide smoothly.

3 ***Guaranteed Interchangeability of Parts*** — because cylinder liners are held to extremely close tolerances.

4 ***Extremely High Efficiency*** — due to good compression, without piston rings.

Regardless of whether you manufacture miniature engines or those for a B-29, or precision bearings, the accuracy and smooth finish produced by the Sunnen Precision Honing Machine can mean longer life, smoother operation, and closer fits on all bearing surfaces from .125" to 2.625" in diameter. Accuracy is guaranteed within .0001" with a super-smooth finish. Can be used in all metals, plastics, ceramics, glass, etc. Accurately duplicates sizes. Requires no skilled labor. Can be set up in one minute. Economical to operate.

Why not call in a Sunnen engineer — or write direct to find out exactly what the Sunnen Precision Honing Machine can do for you. If you have sample parts send them to the Sunnen Honing Laboratory for a test run.

Typical Jobs

Cast Iron Valve Stem Guide. 1/2 to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Roller Bearing Outer Race. Finish improved from 12 micro-inches to 2 micro-inches.

Compressor Yoke. Alignment maintained and better finish produced.

120

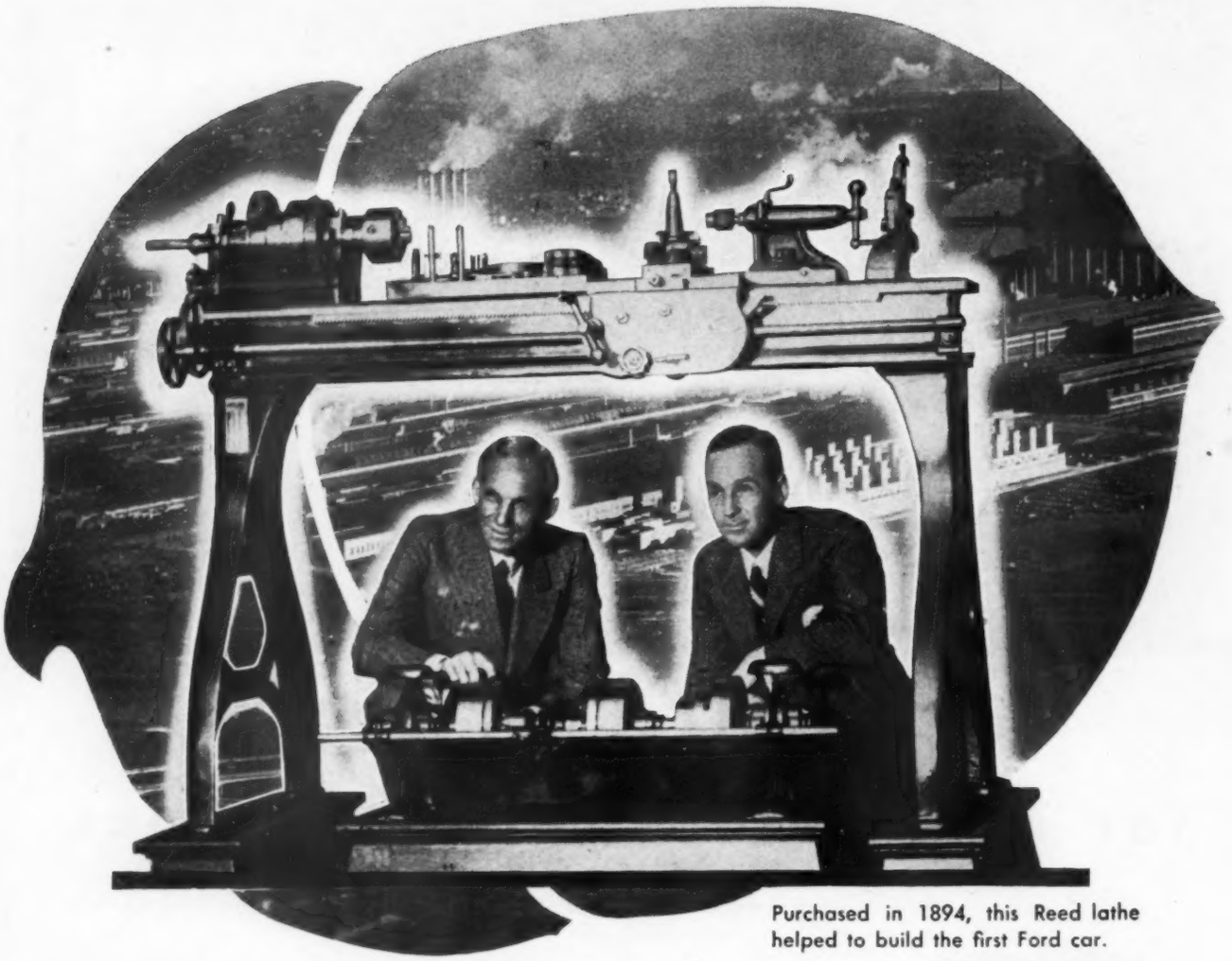
SUNNEN

SUNNEN PRODUCTS CO.

7941 Manchester Ave.

St. Louis 17, Mo.

Canadian Factory, Chatham, Ontario



Purchased in 1894, this Reed lathe helped to build the first Ford car.

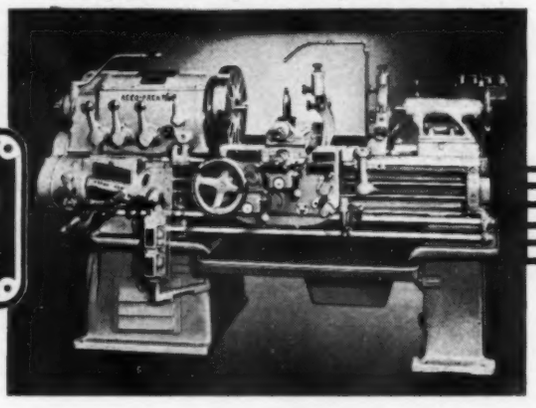
Progress That Was Predestined!

As "great oaks from little acorns grow", so have these two builders of industry, from a meagre beginning, contributed toward the achievement of American mass production. Henry Ford with his vision that resulted in a vast industrial organization — Reed-Prentice with persistent engineering development of engine and toolroom lathes for high speed precision work.

Like the first Ford, this 10" lathe became the fore-runner of the modern, efficient models now available. Built for speed, durability and operating economy, the Reed-Prentice Sliding Gear Head 14", 16" engine, toolroom and the 20" engine lathes of today, represent the ultimate in machine tool construction. Write now for information on sizes, standard and special equipment.

Detroit Honors Its Automotive Pioneers — Golden Jubilee May 31 to June 8

14" Reed-Prentice Sliding Gear Head toolroom lathe



MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

NEW YORK OFFICE: 75 West St., New York 6, N. Y.
CLEVELAND OFFICE: 1213 W 3rd St., Cleveland 13, Ohio

Here's a fast, economical method for cutting high quality Embossing Dies!

Courtesy Cadillac Stamp Co.

GORTON 3-Dimensional Pantograph Rough and Finish Cuts Die for Stamping Aluminum Bottle Caps at One Setting in One Hour

This large eastern manufacturer recently received an order for a die for embossing aluminum milk bottle caps. Nothing like it had been cut prior to the order so no set procedure had been established.

The job was tooled up on several machines in an effort to find out which would produce the most satisfactory results in the least amount of time. The outcome was definite and decisive. Of the machines used, the Gorton 3L Pantograph gave the best performance. Not only did it turn out the best die but turned it out in the record time of one hour.

Adaptable to Light Production Milling and Engraving Operations

Gorton Pantographs have no equal in the performance of intricate milling and engraving operations. They can be used for the profiling of grooves, contours and other shapes; for the cutting of dies and molds; for engraving numerals and designs in any machinable material; and for numerous other purposes. A special roll attachment makes it possible to work from a flat master or model around rolls, dies, dials, knurls up to 6" in diameter. Gorton Pantographs are available in two and three dimensional models to handle many sizes and types of work.

Consult Gorton Engineering Service

Perhaps some of the work at which you are now engaged could be accomplished better, faster and with greater economy on a Gorton Pantograph. If you will submit detailed prints of your job to Gorton Engineering Service, our engineers will thoroughly investigate the possibilities and send you a complete report of the results. This service is offered free and without obligation.

JOB FACTS!

NAME OF PART—Milk Bottle Cap Embossing Die—Used in the manufacture of aluminum milk bottle caps.

MATERIAL—Tool steel—hardened and chrome plated after.

MACHINE—Gorton 3-Dimensional Pantograph, Model 3-L.

OPERATIONS—

1. Rough within .001"; depth .008"; speed 2300 r.p.m.
2. Finish in one cut, depth .001"; speed 2300 r.p.m.

TIME—One hour.

FREE... Complete Information

For complete information on the Gorton Pantograph, write today for Bulletin No. 1655.

GEORGE GORTON MACHINE CO.

1506 RACINE STREET, RACINE, WISCONSIN, U.S.A.

All of the parts shown below were cut off on an ETNA Tube Cutoff Machine

THE TUBE REMAINS STATIONARY . . . IT'S THE CUTTER HEAD THAT ROTATES!

The ETNA Tube Cutoff Machine leaves behind all ordinary tube cutting methods by holding the tube or sleeve to be cut stationary while a pair of revolving cutters do the job. The cutoff cycle—clamping of tube, cutting off and unclamping—is completely automatic, handled entirely with pushbuttons. Traverse and stepless, infinite range of spindle speeds is also easily adjusted. These units are easily installed . . . connect three wires and go into production!

The spindle, on which tool holders are mounted, runs on Timken tapered roller bearings—is V-belt driven by a Louis Allis Adjustable Speed D C Motor. Etna builds the Tube Cutoff Machine in capacities to handle tube ranging from ½" O. D., ⅛" Wall up to 12" O. D., 1½" Wall. Units for tube over 5" O. D., 1½" Wall are built to order.

THE ETNA MACHINE CO., TOLEDO 10, OHIO

THERE IS No Substitute for HONING

These piston rods for recoil or recuperator cylinders are honed on a BARNESDRIL *No. 5E Horizontal EXTERNAL Hydraulic Honing Machine. Rods are 4½" and 1½" diameters. Accuracy for uniformity. Accuracy for taper in these rods 8 feet long—within .0001" to .0002". Could be honed to zero, if necessary.*

THIS PRECISION PRODUCTION PROCESS GIVES EXTREME ACCURACY AND SUPERIOR FINISH

Honing is applied to generate finished surfaces in cylinder bores or on external surfaces of certain cylindrical parts. Honing begins at the rough machined surface, cuts down to base metal quickly, then delicately completes final finish and establishes the required size precisely. Substantial amounts of stock are removed most economically at high speed. Honing, usually the final processing operation, corrects previous machining errors, while generating final size, accuracy and finish.

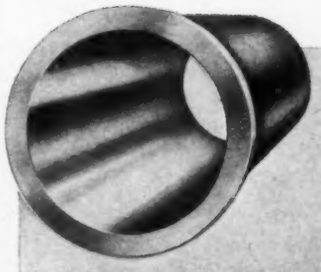
Honing *generates* (1) diameter roundness and (2) diameter straightness. Honing *corrects* (1) out-of-roundness and (2) taper.

BARNESDRIL HONERS AVAILABLE FOR A VARIETY OF INTERNAL AND EXTERNAL HONING APPLICATIONS...

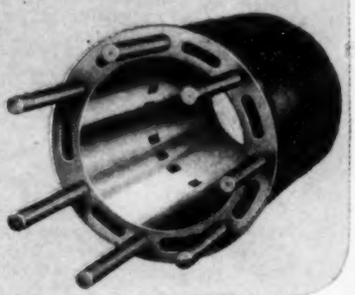
BARNESDRIL hydraulically controlled Honers generate a true circle or diameter on a neutral axis as developed by boring or grinding. They will control and develop constant diameters and produce an extra fine finish.

BARNESDRIL Honers are fast and easy to operate. They give you maximum production at minimum cost; save time, labor, floor-space, work-handling, operator training; and many intermediate machining operations. A wide variety of sizes, with suitable equipment, are available in BARNESDRIL Vertical and Horizontal Honing Machines—Internal and External—to handle any size, length or kind of work that can be honed.

If you are not using the honing process today to secure precision accuracy, superior finish, higher production and greatest economy on your final finishing operations, BARNESDRIL engineers will show you how to adapt the honing process to your work. There is no obligation for this service.



17½" diameter by 5 foot long Diesel engine sleeve honed on large BARNESDRIL No. 4030 Vertical INTERNAL Hydraulic Honer, showing beauty of the surface finish to an accuracy of within .001" for roundness and straightness.



Diesel engine cylinder with studs set is honed on a BARNESDRIL Vertical INTERNAL Hydraulic Honing Machine, showing mirror smoothness of bore.

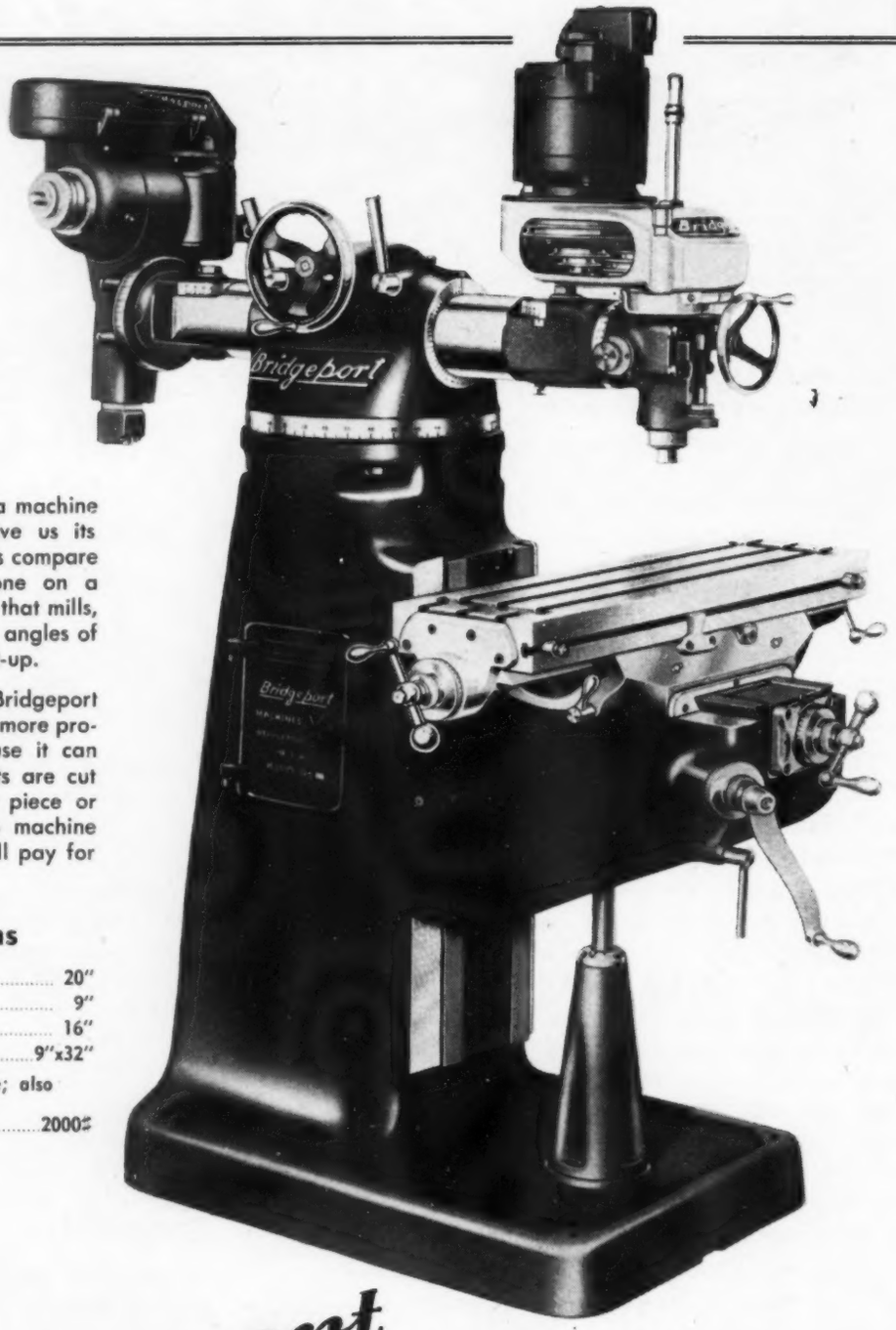
Send for this FREE Bulletin

No. A-121 which describes the Honing Process, with complete description of BARNESDRIL Honing Machines available for both internal and external honing.

Barnes Drill Co. 830 CHESTNUT STREET ROCKFORD ILLINOIS, U.S.A.

Bridgeport

TURRET MILLING MACHINE



If you are in any doubt that a machine in your shop is obsolete, give us its performance figures and let us compare them with what can be done on a "Bridgeport" . . . the machine that mills, drills, bores and shapes at all angles of the work without changing set-up.

The extreme versatility of the Bridgeport Turret Milling Machine assures more productive machine hours because it can be kept busy. Time and costs are cut whether it is used on single piece or quantity work. It is a 1946 machine for 1946 requirements and will pay for itself in savings.

Specifications

Longitudinal Feed	20"
Cross Feed	9"
Vertical Feed of Knee	16"
Standard Table	9"x32"
Special Tables up to 48" available; also longitudinal power feed.	
Weight with Shaping Unit	2000#

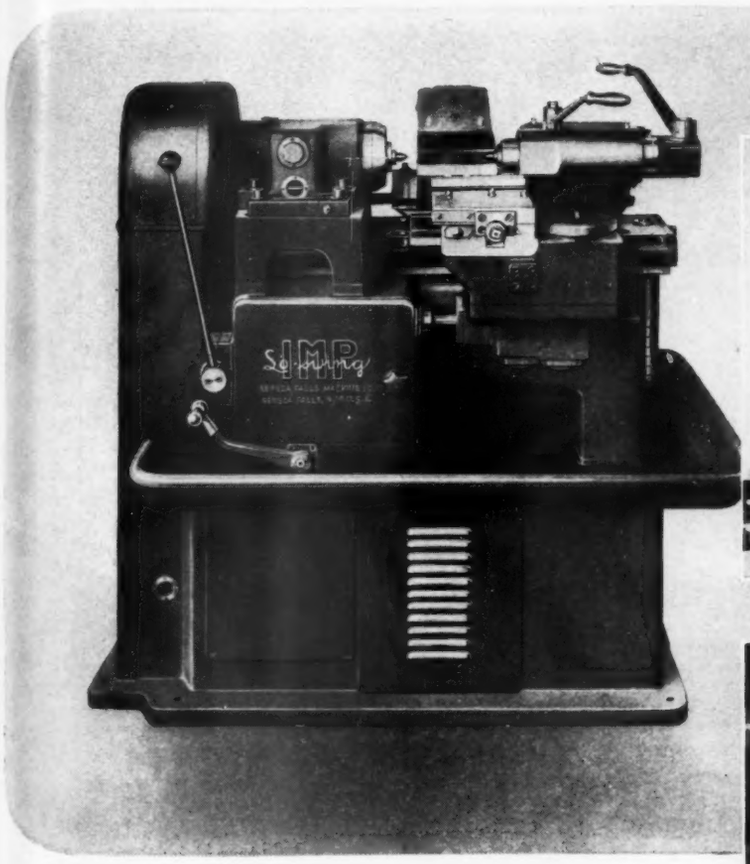
The **Bridgeport**

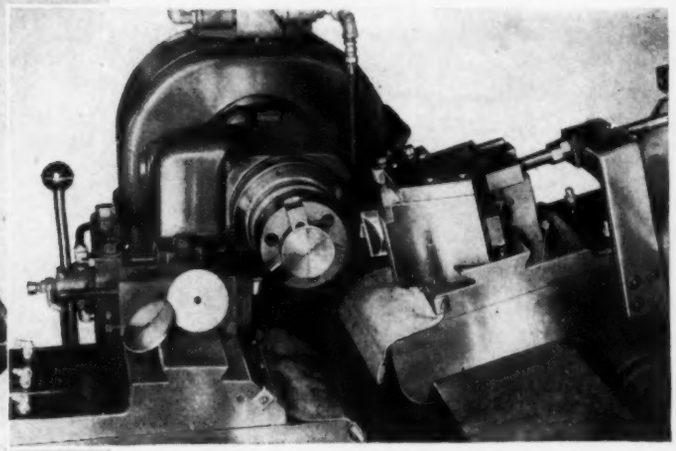
INVESTIGATE TODAY

MACHINES, INC.
BRIDGEPORT CONN.

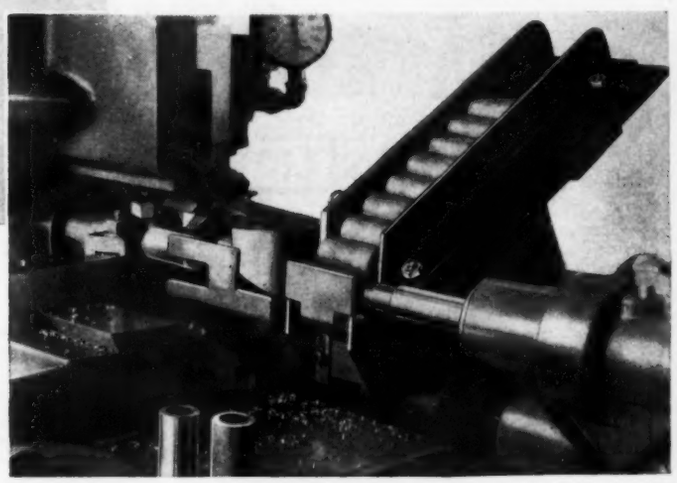
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK





IMP with Back-Squaring Attachment



IMP with Automatic Loader

IMP with Back-Squaring Attachment and Third Slide

Lo-swing IMP

A VERSATILE AUTOMATIC LATHE FOR SMALL WORK DEMANDING HIGH SPEEDS AND EXTREME ACCURACY

• The Lo-swing IMP Lathe lends itself to practically unlimited tooling possibilities. Illustration above shows a standard machine. The close-up views show three typical applications of standard and special attachments to the base machine which have resulted in increased production and lowered costs.

If you have a turning job requiring high speeds, fine finishes and extreme accuracy, write for IMP Bulletin N-42.

SENECA FALLS MACHINE CO.
Seneca Falls, N. Y.

LATHE NEWS from SENECA FALLS

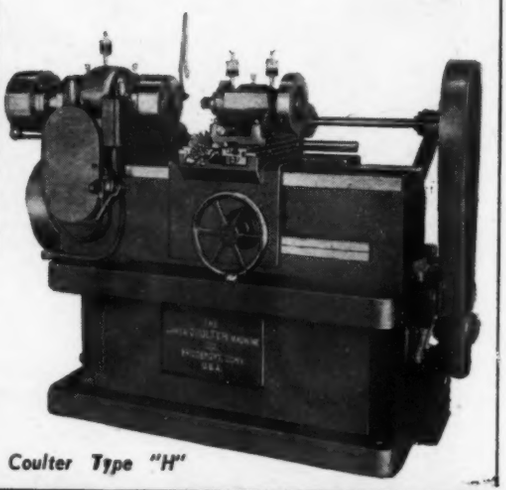
SAVING MINUTES

WHEN MINUTES COUNT

WITH A **COULTER** HOB THREAD **MILLER**

ILLUSTRATED LITERATURE AVAILABLE

ACCURATE HOB THREADING is done with Precision and Speed on this RIGID . . . SIMPLE . . . FULLY MOTORIZED COULTER MACHINE.



Coulter Type "H"

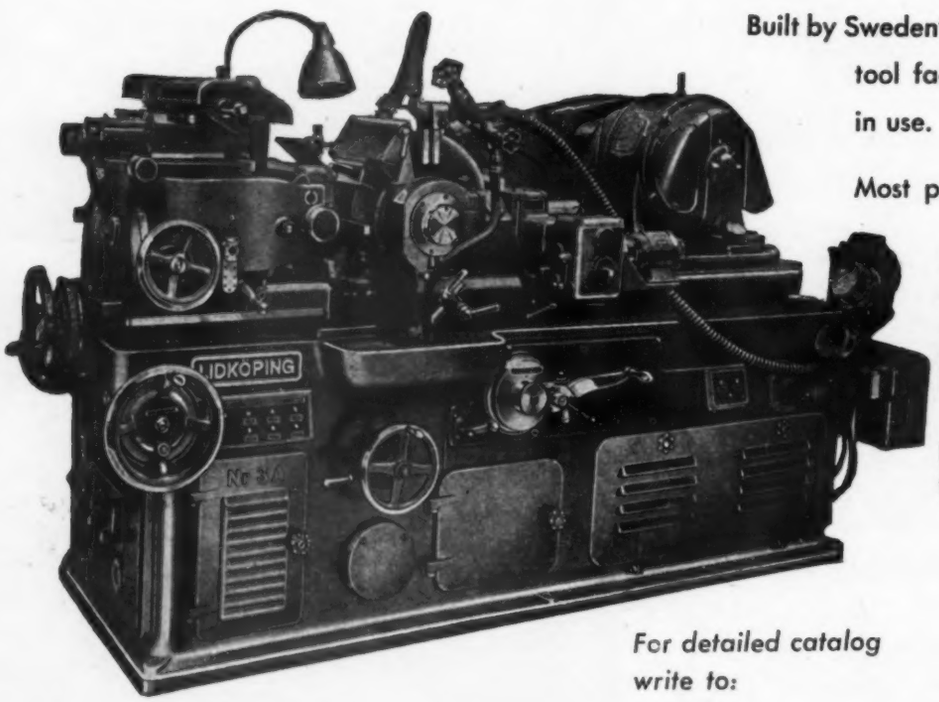
It has unlimited capabilities, with a maximum external thread of 7 inches; either for right or left hand threads, internal or external.

Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chucks, or special face plate fixtures can be threaded on this COULTER TYPE "H".

The James **COULTER** *Machine Co.*

BRIDGEPORT • CONNECTICUT • U.S.A.

SWEDISH LIDKÖPING CENTERLESS GRINDERS



Built by Sweden's oldest and largest machine tool factory since 1922. Hundreds in use.

Most powerful.

Many sizes available for grinding pieces up to 14" diameter, 23" long; for grinding bars up to 6" diameter and 25 ft. long.

Large variety of attachments for:

Through-Feed
In-Feed
Profile
Taper and
Shoulder Grinding

For detailed catalog write to:

TRIPLEX MACHINE TOOL CORP., 125 Barclay Street, New York 7, N. Y.

4606

ROCKFORD
Hy-Draulic
MACHINE TOOLS

Over sixteen years ago the Rockford Machine Tool Co. introduced the first hydraulic reciprocating machine tool. Today our belief in the superiority of hydraulic design stands justified, for Rockford Hy-Draulic Machine Tools have proved themselves wherever and however employed. The exclusive and highly specialized engineering experience that has been ours is fully applied in each machine tool we build.

Every Rockford Hy-Draulic Machine Tool offers such important fundamental advantages as:

1. Ease of control for quick set-up and fast operation.
2. Stepless Speeds . . . infinitely adjustable throughout a wide specified range. Hy-Draulic tool-head feeds similarly adjustable.
3. Efficient, smooth hydraulic pressure . . . maintains cutting speed as set, no matter how work resistances may vary.
4. Smooth, fast reversals and high return-stroke ratios. Oil flow through Hy-Draulic System is instantly reversible. Simplicity of Hy-Draulic System holds inertia factors to a minimum.
5. Fine finish and long tool life. Smoothness of Hy-Draulic drive, free of mechanical play and vibration, protects work and cutter.

Rockford Hy-Draulic Machine Tools assure quality work with speed at minimum cost. Let the Rockford sales engineer give you complete information.

low bridge

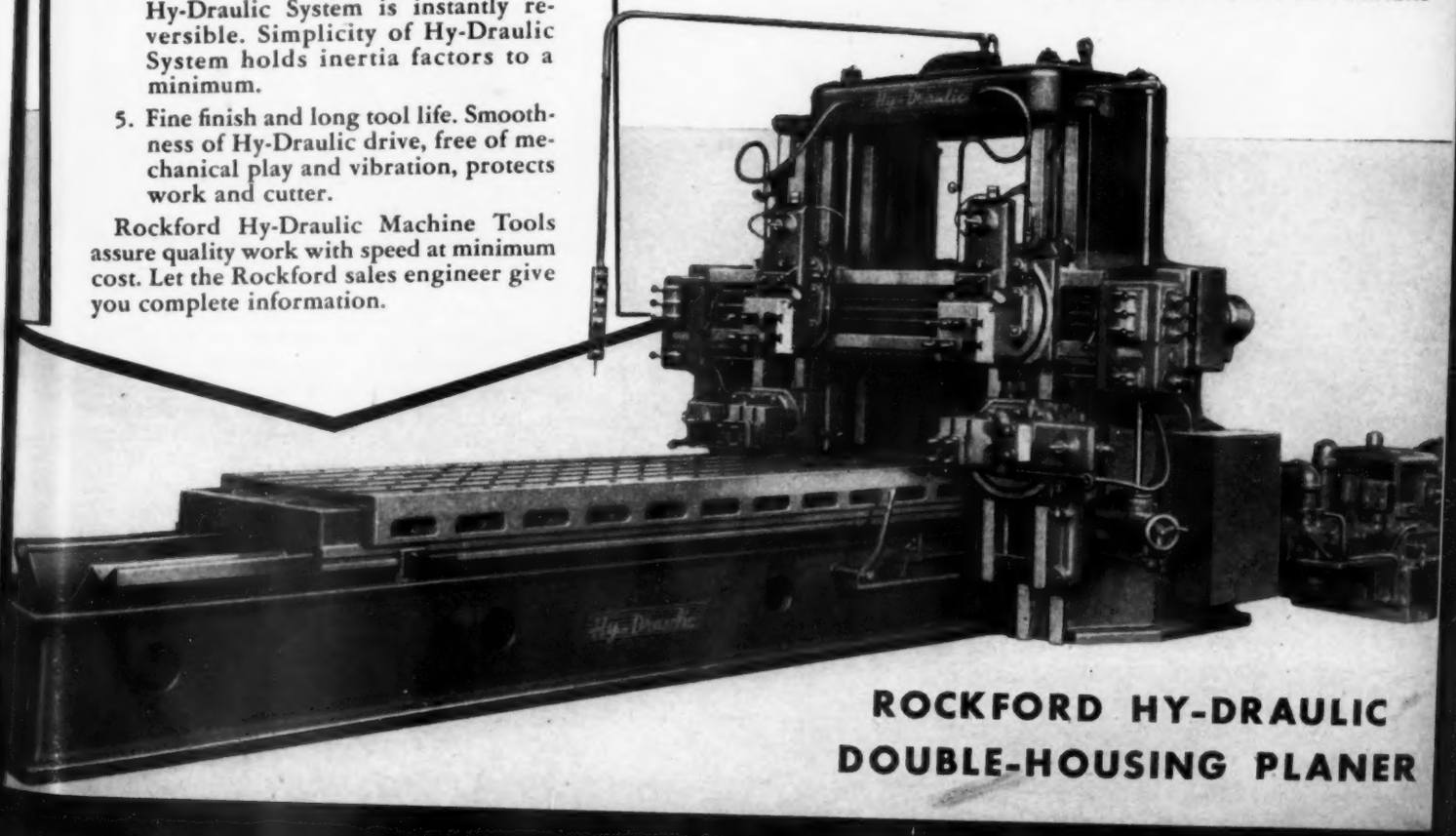
With the cross rail snuggling the top brace, this Rockford 48″x48″ Hy-Draulic Double-Housing Planer is handling a 46″ high, five ton casting with speed, ease and accuracy. On the particular job shown, set-ups require stroke lengths of as little as 8″, with the tool heads feeding across the entire width of the casting. Hy-Draulic drive can take work like that in stride without sacrifice of speed in either cutting stroke or reversal. Rigidity of Rockford Planer construction is also demonstrated here; work is smooth and accurate although the cross rail is raised to near-top position.

Rockford Hy-Draulic Double-Housing Planers are built in four standard sizes, from 36″x36″ to 60″x60″, each size is available in six maximum stroke-length ratings ranging from 10 feet to 20 feet. You are invited to write for complete information on these machines. Ask for Bulletin 1136.

ROCKFORD MACHINE TOOL CO.
ROCKFORD, ILLINOIS

Hy-Draulic

SHAPERS·PLANERS·SLOTTERS·SHAPER-PLANERS



ROCKFORD HY-DRAULIC DOUBLE-HOUSING PLANER

What's Industry's in NEW YORK...

R. E. LE BLOND
President

"There's a telephone round-up on among LeBlond Agents. They're telling us about Industry in their home towns. Here are the first two reports..."

L. H. ROEMER
LeBLOND
NEW YORK CITY

"The rest of the country doesn't always think of us main-stemmers as heavy manufacturers but that's what we are. We use a lot of tooling here and I see a great many precision parts going through. It's interesting to check and find that LeBlond lathes enter a lot of their pictures. Here you see me watching a LeBlond 12" Tool Room Lathe cut a spindle sleeve at the NEWARK GEAR CUTTING MACHINE CO., Newark, N. J. Tolerance....0001"!

LeBlond 12" Tool Room Lathe.

All over industrial U.S.A., LeBlond lathes are pacing the drive to greater productivity with modern metal cutting and finishing performance. Look up the LeBlond Agent nearest you. He knows metal turning as few men know it and he's pretty sure to have the answer to any lathe problem you have in mind.

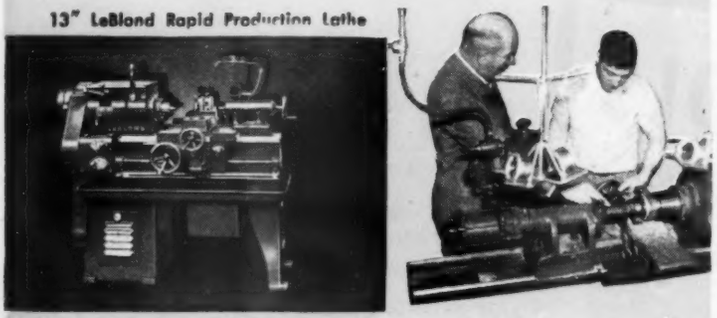
Story ...ST. LOUIS

JOHN W. VOGLER
JOHN W. VOGLER CO., INC.
ST. LOUIS, MO.

John Vogler and a 14" LeBlond Tool Room Lathe at the NATIONAL BEARING DIVISION, AMERICAN BRAKE SHOE CO., St. Louis, Mo.

"Talk about diversification of Industry. We have it. And we find, as we install LeBlond lathes in a lot of plants, that we have a variety of lathes in our LeBlond catalog that we can draw on to show results on any job. Our lathe customers haven't stumped us yet and we're sure they never will. Some talk precision . . . some talk production. With LeBlond, we'll answer them both."

13" LeBlond Rapid Production Lathe

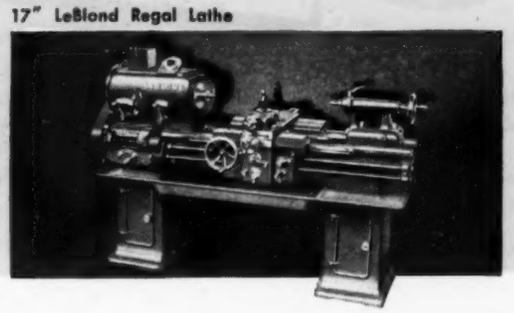


A battery of three 13" LeBlond Rapid Production Lathes, with air-operated chucks at the hermetic motor plant of THE EMERSON ELECTRIC MFG. CO., St. Louis, Mo. Here, motor rotors with a machined surface 1¼" wide are roughed .020" and finished .010" in 60 seconds. Plus or minus .001" easily held under hard driving and high temperatures.

ROBERT P. McDONALD, JR.
McDONALD MACHINERY CO.
ST. LOUIS, MO.

"We know something about costs here in St. Louis and that leads a lot of smart lathe buyers right to Regal lathes. On a cost per hour per finished piece basis, I've shown plenty of plants that Regal lathes can lead them right to a competitive position that really puts them in the market. For a good solid job, where frills don't count, my customers . . . like the FRED J. SWAINE MFG. CO., St. Louis, Mo., in this picture here . . . are sold on that Regal lathe."

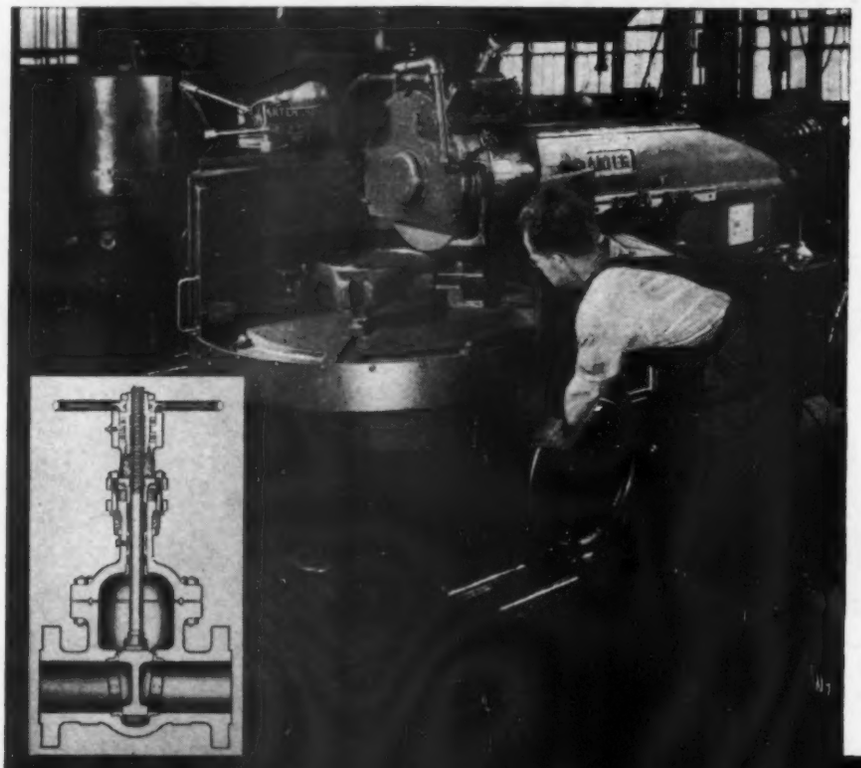
17" LeBlond Regal Lathe



The R. K. LeBlond MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

NEW YORK 6, Singer Bldg., 149 Broadway, WOrth 2-0722 CHICAGO 6, 20 N. Wacker Drive, STA 5561

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES



The name Crane Company founded by R. T. Crane in 1856 is known for high quality—valves and fittings as well as pipe, plumbing, heating and pumps.

ARTER
ROTARY SURFACE GRINDERS

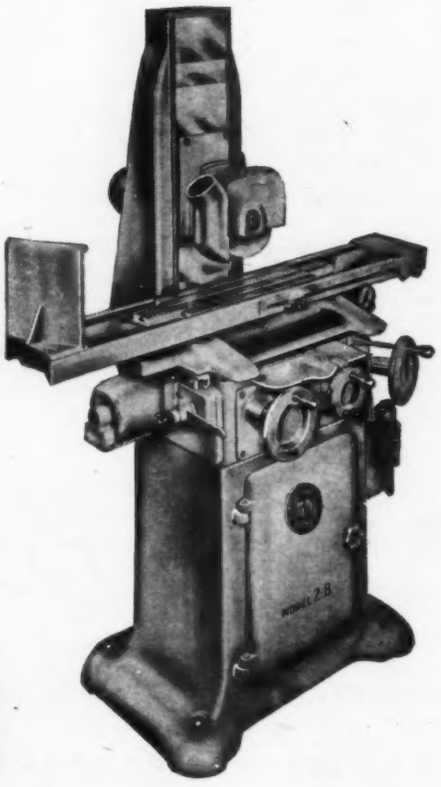
are employed to grind the disc used in steel gate valves, insuring accuracy needed for continuous successful operation. These discs are ground on MODEL B ROTARY SURFACE GRINDERS using 10 degree angular fixture.

Another interesting ARTER grinding job — another example of ARTER versatility.

ARTER GRINDING MACHINE COMPANY
WORCESTER, MASSACHUSETTS • U. S. A.

PRECISION REID SURFACE GRINDERS

CONTROLS
"At Your Fingertips"



WHETHER YOUR SHOP is small or large, the use of a REID PRECISION SURFACE GRINDER will be of great value to assure (with a minimum of effort) precision results. Take advantage of all the improvements that are incorporated in Reid Machines. New illustrated bulletin giving full specifications will be sent promptly on request.

ILLUSTRATED IS THE REID MODEL 2-B ALL-ELECTRIC POWER-FEED

The Reid model 2-C hand-feed also is an exceptionally fine machine for tool, gage, die and certain production grinding.

MACHINES EQUIPPED FOR WET GRINDING IF REQUIRED

EXCELLENT DELIVERIES

DISTRIBUTORS CONVENIENTLY LOCATED IN ALL SECTIONS
WRITE DEPT. H FOR ILLUSTRATED BULLETIN AND PRICES

REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS

Drilling 1140 HOLES *per hour . . .*

SAVES TIME – MONEY *and* LABOR . . .

"Says Stop-Watch Pete of BAUSH"

Designed and built to do one specific job speedily and economically, this BAUSH 2-Way Hydraulic Unit Type Multiple Spindle Drilling Machine drills 30 holes in the top and 8 holes in the side of 4-cylinder engine block heads—a total of 38 holes in one drilling operation—with 30 heads completed each hour.

Backed by more than 50 years of experience and leadership in the Machine Tool Field, Baush Engineers are capable and ready to solve YOUR tapping-drilling-reaming or boring problems—*why not phone, wire or write us today.*

Welded steel base is arranged for coolant—arch type column is welded steel. Baush Vertical self-contained #30 hydraulic unit has fixed center head furnished with 30 spindles. This unit is perfectly balanced by counter-weight suspended inside vertical column.

Baush Horizontal self-contained #20 hydraulic unit has fixed center head furnished with 8 spindles.

All spindles have vertical adjustment to compensate for tool wear.

Both units have hardened steel ways and 18" max. stroke hydraulic pump and cylinder. Approach, feed and return synchronized to suit operation of intersecting holes in part.

Part loads on hardened rails at machine front, then is slid into fixture and is located with retractable pins in locating holes in bottom face and is clamped down with 2 cam operated planer type clamps.

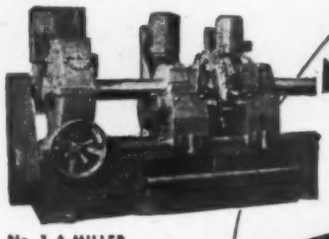
BAUSH

MACHINE TOOLS

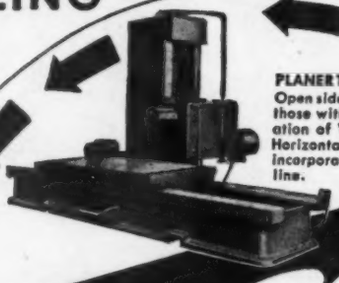
SPRINGFIELD 7, MASSACHUSETTS

MILLING, DRILLING REAMING—

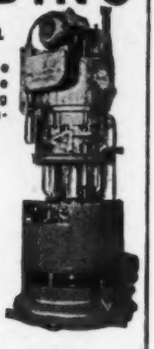
BORING and THREADING



PLANER TYPE MILLER
Open side, as well as, those with a combination of Vertical and Horizontal Heads are incorporated in this line.



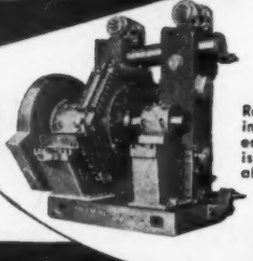
8 SV VERTICAL DRILLER
Operations are continuous of the non-indexing type. 8 or 10 spindles available.



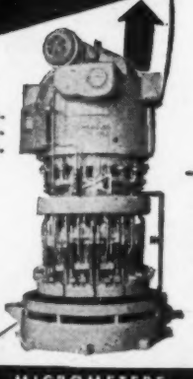
Roto-Matic

No. 1-A MILLER
One of a series of continuous operating milling machines adaptable to automatic or hand clamping.

DOUBLE END HORIZONTAL DRILLER
12 to 24 Spindles—self feeding—continuous operation—automatic chain or hand clamping.



12 V VERTICAL DRILLER
Continuous operating having a capacity of 1½ in. in steel.



No. 4 MILLING MACHINE
Roughing and finishing cutter spindles in each column with finishing spindles adjustable for toe cut.

MICROMETERS & GAGES
Hollow steel frames of highest quality construction give a lifetime of accuracy. Special designs available.

FOR ADDITIONAL INFORMATION ASK FOR CATALOG A-90

MACHINE TOOLS—
PIPE THREADING MACHINERY

MICROMETERS — SNAP GAGES
SPECIAL TOOLS AND GAGES

DAVIS & THOMPSON COMPANY

MILWAUKEE — MFRS. OF MACHINE TOOLS & MICROMETERS — WISCONSIN

TIME-SAVING MACHINE TOOLS SINCE 1901

Moline Tool Company since 1901 has been designing and building machine tools of the highest degree of efficiency for these operations:

- Boring—rough, semi-finish and finish
- Honing
- Milling—(special machines)
- Straight Line Drillers
- Universal adjustable spindle drillers
- Way Type Machines—horizontal and vertical drilling, tapping and boring machines

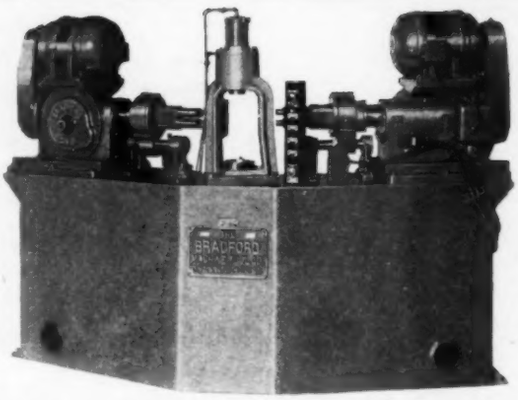
"Hole Hog" machine tools are versatile—their construction makes possible easy change-over to other jobs. They are easy to operate and are ruggedly built for years of continuous production service. For man-hour savings—for more efficient, smoother work—look to Moline machines.

Write for information concerning machine tool equipment for your special problems.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

MOLINE TOOL COMPANY

105 20th Street — MOLINE, ILLINOIS



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235 PARTS PER HOUR WITH THIS *Bradford* AUTOMATIC TAPPING MACHINE

Bradford Two-Unit 4 Spindle Horizontal Type Reversing Motor Tapping Machine for increased production at less cost per piece.

Taps two 5/16-18 and two 7/16-14 holes in transmission extensions at the rate of 235 parts per hour at 85% efficiency.

Each unit equipped with a two-spindle auxiliary fixed center gear driven head. Fully electric control.

Write for Bulletin 500

The BRADFORD MACHINE TOOL CO.

1840 1946 — CINCINNATI, OHIO

BIG CHIP—FAST CUT • •

Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32-inch sizes.

WHEN MAKING A DEEP CUT on a heavy duty lathe, the machine first must be geared, powered and designed to take this rugged job in its stride... Lumbermen have a saying, "the bigger the chip, the quicker the cut."... In a close-up photograph, above, an *Axelson Heavy Duty Lathe* is demonstrating the same principle... The operator has the complete assurance that experience develops on this great lathe... From heaviest roughing cut to the finest precision metal turning, the *Axelson Lathe* turns in also an unvarying record of satisfaction, from manager and machinist alike... For the *Axelson Lathe* is a quality machine, of finest materials and workmanship... It has taken over thirty years of unflagging enterprise to produce this machine tool, to meet every demand in metal turning.

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AXELSON LATHES

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

Dependable for over a Quarter Century

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Blake

COMPANY

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PUT YOUR TAP SHARPENING

on a

Production Basis

with the

BLAKE TAP GRINDER

The Blake Tap Grinder—like your production machines which you have chosen carefully and wisely—will give you the maximum returns on your investment of man-hours and money.

***Every* operation necessary for the *accurate* chamfer sharpening of taps has been reduced to take the least possible amount of time. Some of these "production-sharpening" features of the Blake are:**

- **Taps may be inserted or removed in a few seconds.**
- **It's easy to change from size to size.**
- **You can sharpen right-hand or left-hand taps *without any change* in the machine.**
- **You can sharpen a wide variety of taps, with 2, 3, 4, 5, 6, 8 or 10 flutes. (Also sharpen countersinks, the lead on reamers, 3- and 4-fluite drills, step drills, and many other tools requiring relief on the point.)**
- **It has a special adjustable eccentric mechanism which allows *both* the chamfer angle and the relief—*of all the lands*—to be ground in one *continuous operation.***

You can't afford to risk having your production machines idle because of a lack of sharp, accurately ground taps. Mail the coupon today for complete details.

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail. A.M.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—HAGER CARBIDE TOOL GRINDERS

. . . for high speed, fine uniform finish use the TYPE "S" "PRODUCTION"

The Type "S" Production Centerless Grinder combines a centerless feed polishing machine with a vertical or horizontal surfacer, polisher or buffer. It will handle cylindrical work ¼ to 1" diameter automatically when equipped with Centerless Feed Attachment.

This machine also provides the means for handling straight line finishing of flat work by hand manipulation, and assures fine work even with inexperienced operators. Any material that can be ground or polished can be finished on the Type "S".

SPECIFICATIONS

Abrasive Belt . . . 4" wide, 60" long
Belt Speed . . . . 3200' per min.
Table . . . . 4½"x13½"
Dist. Table to Floor . . . 36"
Motor . . . . 1 H.P., 1750 rpm.
Ball Bearing equipped

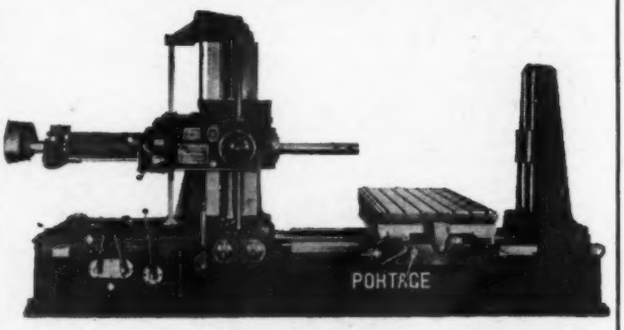
Write for illustrated literature giving full details

PRODUCTION MACHINE CO.

Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.

GREENFIELD, MASS., U. S. A.

PORTAGE



NO. 4 HORIZONTAL BORING DRILLING & MILLING MACHINE

- **A ruggedly built machine capable of operation at maximum speeds and feeds to produce accurately finished work. . . . Machine furnished with coolant type table with either 36" x 60" working surface and 48" cross travel, or 48" x 72" working surface and 60" cross travel. . . . Extra height columns increase working capacity. . . . For greater speed—precision—high production specify PORTAGE.**

WRITE for full descriptive bulletin today.

THE PORTAGE MACHINE CO.

AKRON 11, OHIO

ADAPTABILITY *Plus!*

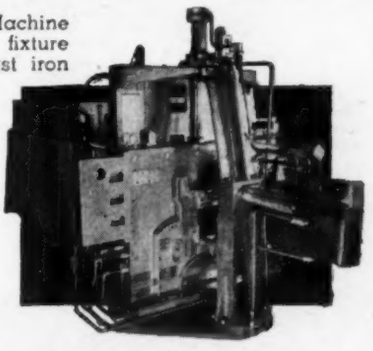
Four bearing surfaces for Cam and Crankshaft Boxes of Draper High Speed Looms, dry cut from gray iron castings with only two passes of the broach per part.

Typical of the diversity of machining operations, capable of being performed more efficiently by broaching, are the bearing surfaces of cast iron loom frame ends, dry cut to a tolerance of .004. Fitted to a standard Lapointe HP-30, an ingenious fixture hydraulically clamps the work in position and indexes the part for each of its two broaching operations.

By means of two cam plates, this fixture provides a 13" vertical and a 3" horizontal travel, to enable it to position automatically these large opposing loom frame ends. The broach is retracted on its cutting stroke, and cannot be returned until the fixture has established full clearance.

Usually associated with high-speed production of precision parts to hairline tolerances and mirror finishes, this operation demonstrates the amazing flexibility of the broaching process as employed by the men of Lapointe. Their engineers will prove to you in your own plant, that broaching can perform almost any machining operation, Quicker, Cheaper . . . and BETTER!

Lapointe HP-30 Horizontal Broaching Machine with hydraulically operated indexing fixture for broaching bearing surfaces of cast iron loom frame ends.



THE *Lapointe*

MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

IF YOU'RE LOOKING FOR **TRULY HIGH PRODUCTION**

investigate this

PORTER-McLEOD COLD METAL SAWING MACHINE

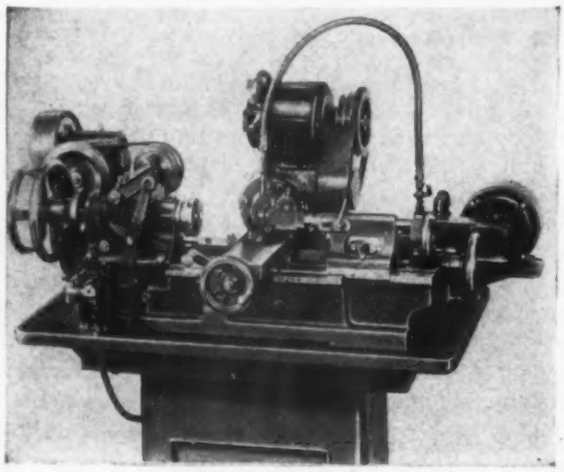
Your problem of relieving bottlenecks in cutting-off operations and keeping production moving at top speed can be solved by this 8" powerful, convenient Porter-McLeod machine.

With a capacity for cutting 8" round or 7½" square stock and arranged so that stock can be nested for multiple cuts together with a standard feed of 3" per minute, a wide variety of work can be cut on a high production basis.

Speed with safety and accuracy is assured by pulling the blade upward through cut, with blade supported close to its rim to eliminate the possibility of buckling and weaving. A friction disc feed insures against blade damage and breakage. Blade design is such that every tooth cuts.

Get all facts today concerning this fast, accurate, straight-cutting machine. Write for Illustrated, Descriptive Bulletin.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.



Specifications:

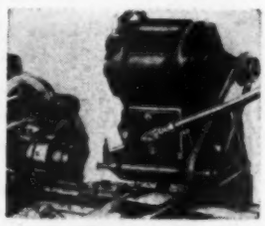
Swing over carriage—3"
Capacity—(dia. of work)—2" or smaller
Thread length (work on centers)—8¾"
Thread length (work chuck-held)—10"
Dia. hole through spring chuck—⅝"
Dia. hole through work spindle—¾"
Max. distance between centers—12"
Floor space—48" x 34"

Write for Bulletin 244A

Fast, PRECISION THREADING *of* SMALL PARTS *Assured . . . by* WALTHAM THREAD MILLERS

All standard forms of threads can be milled to closest precision on these fast, versatile, convenient machines. Waltham is in position to furnish the various cutters required.

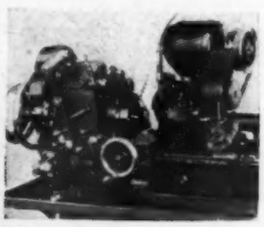
Three motors are employed on WALTHAM machines, permitting individual speed changes for cutter and work and constant speed for pump. Available speeds are provided for cutting either brass or steel. A single start and stop station controls all motors.



Machine equipped with Internal Threading Attachment

EXTRA EQUIPMENT

Special equipment, extending the utility of WALTHAM THREAD MILLERS, includes attachment for relieving, taper, internal threading, multiple cutter threading, translating gears, metric lead screw, cam operation, special tailstock for multiple cutter work.

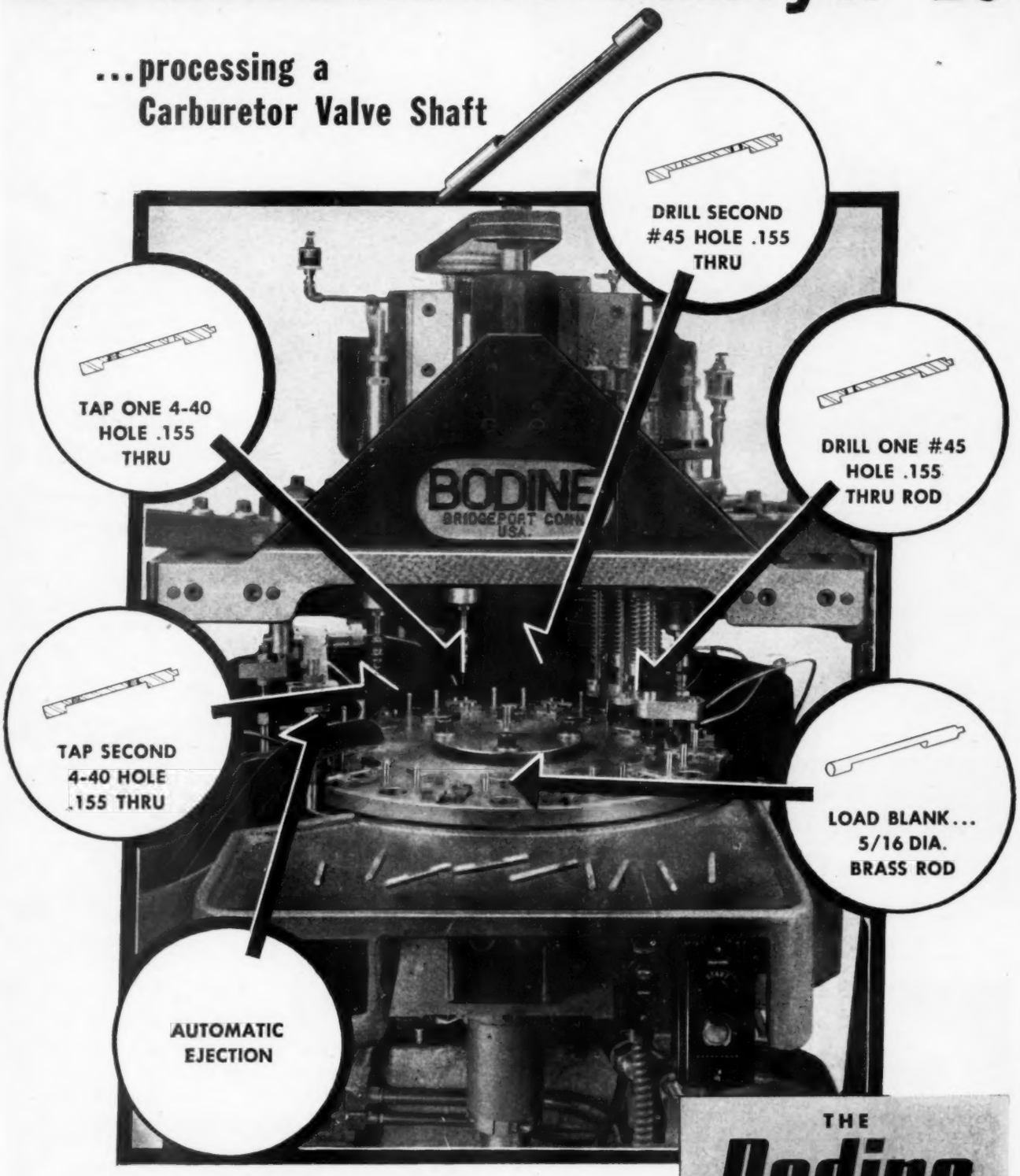


Machine equipped with Relieving Head

WALTHAM
MACHINE WORKS,
WALTHAM, MASS.

Bodine..Case History Nº 16

...processing a Carburetor Valve Shaft


DRILL SECOND #45 HOLE .155 THRU
TAP ONE 4-40 HOLE .155 THRU
DRILL ONE #45 HOLE .155 THRU ROD
TAP SECOND 4-40 HOLE .155 THRU
LOAD BLANK... 5/16 DIA. BRASS ROD
AUTOMATIC EJECTION
BODINE
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• Production . . . 1250 pieces per 50 minute hour, one completed piece per stroke of the Bodine Dial type Drilling and Tapping Machine. Interesting Bulletin on request.

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BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

510 MODEL
OLIVER DRILL POINTER

Test the Oliver Drill Point on your drilling equipment. We will gladly grind a few test drills for you — no obligation.

Don't Neglect Your Toolroom It's the Backbone of Production!

a point TO REMEMBER ABOUT OLIVER'S DRILL POINTER

Maximum efficiency of twist Drills depends upon proper grinding of the point and it is a proven fact that machine grinding is more accurate . . .

The Oliver 510 Drill Pointer is the machine which covers the entire range of Drills from 1/4" to 3" in Diameter.

Fig. 2

GRINDING of POINT

Satisfactory results are obtained only when the drill point is ground correctly. This means that the two cutting lips are ground on the same angle with the axis of the drill. Our experience shows that a 59 degree angle is best for general purpose work. (See Fig. 1.) If cutting lips are ground different lengths the drill cuts holes oversize. (See Fig. 2.)

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For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

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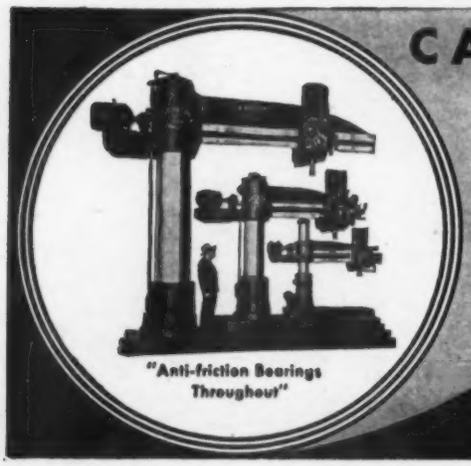
Giant KEYSEATERS



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CARLTON RADIAL DRILL

FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

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ARMY E NAVY

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IN 9½ HOURS ON A Cleereman DRILLING MACHINE

Less than 1½ minutes is required to finish one of these blower housings. It is bored through the center boss, the outside diameter of the boss is turned, and the interior and bottom of the piece is machined, all in one operation, in a special fixture attached to a Cleereman Drilling Machine. Limits are 0.001 in. on the diameter of the large bore, 0.001 in. on the depth of the large bore, and 0.0005 in. on the diameter of the small bore.

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AFFILIATED WITH

CLEEREMAN MACHINE TOOL CO. *MANUFACTURER OF PRECISION JIG BORERS & DRILLING MACHINES*

MOREY *Universal* TURRET LATHES
for BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
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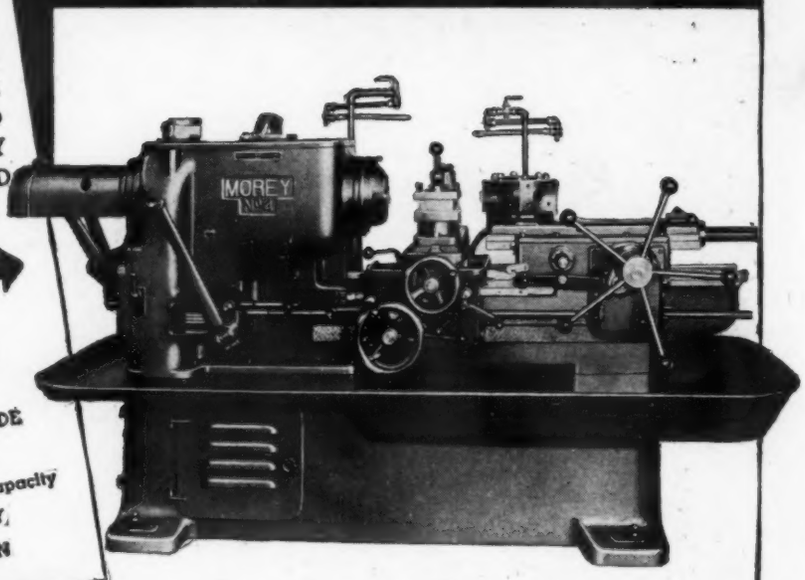

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MOREY MACHINERY CO., INC 410 BROOME STREET, NEW YORK 13, N. Y.
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Automatic Tapping Machine

Taps better Threads—faster

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Model DB with Special Rapid Approach

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Give your tap a chance to produce better threads. Our lead screw completely controls thread accuracy through the entire tapping cycle, taking the load off the tap. As a result Class 3, 4 and 5 gauge fits are being produced on a production basis.

Five Outstanding Features

- Lead Screw Controlled
- 100 Per Cent Automatic
- Precision Depth Stop
- Split Second Reverse

Full descriptive bulletin available Write for your copy today.

Also designers of Special Tapping equipment.

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Cut tool room costs way down by making small dies, jigs, fixtures, patterns and models on a Linley Milling and Jig Boring Machine. Setup and changeover on fussy little jobs are done in a fraction of the time consumed by using larger and and more expensive machines for this purpose.

Eight velvet-smooth spindle speeds to 4250 r.p.m. give the Linley a speed for every need. Direct micrometer setting eliminates errors . . . speeds setup. Takes up only 2½ sq. ft. of space, yet has ample (7"x 17½") table which travels 10" lengthwise, 6" across; 3" quill travel has no backlash.

See Our Bulletin

LINLEY BROTHERS COMPANY
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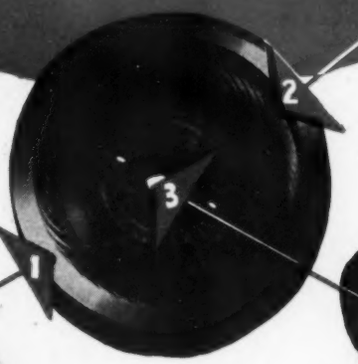
BRIDGEPORT 1, CONNECTICUT

3 SURFACES GROUND... WITH ONLY 1 CHUCKING

PROBLEM—To grind three surfaces, maintaining the two concentric i. d.'s perpendicular to plane surface. 1. This ground surface must be oil-tight when assembled, with a tolerance of .0002". 2. Surface must be ground exactly perpendicular to the annular (ring) surface, tolerance, .0002". Square corner must be ground without a recess. 3. A 1" internal cylindrical surface on one half, ⅜" on the other half.

Step 2 This clutch part must have the thrust equalized throughout the internal, perpendicular surface which is held to .0002".



Step 1 Spindle is set at an angle; cup wheel grinds in a concentric pattern. .0002" tolerance provides oil-tight joint.

Step 3 Spindle speed is increased to 32,500 s.f.p.m. Small wheel is used for the internal shaft hole, tolerance, .0002".

DATA **PART:** Overrunning clutch casing for a punch press. **MATERIAL:** Hyt-M70 Carbon Steel (62-64 Rockwell). **WHEELS:** Nubon W-60-K, 2" cup, 14,600 s. f. p. m. Carborundum E-60-P-100, ⅝" x ¼" x ⅛" 32,500 s. f. p. m. **GRINDER:** Dumore No. 5.

For the unusual grinding job as well as the routine . . . look to Dumore. As an example, here's how Tools, Inc., of Chicago, used a Dumore No. 5 Grinder with exceptionally fine results. Finish and accuracy were easily achieved, and there was an actual reduction in the working time involved.

The Dumore Company, Tool Division, Dept. TF14, Racine, Wisconsin. Eastern Sales and Service Branch, 13 East 40th Street, New York 14, N.Y.

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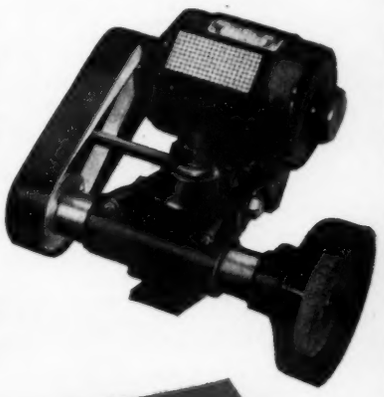
MASTER PRECISION GRINDER

The ½ H.P. model is the most versatile of Dumore Grinders. 11 quick-change quills for .0001" accuracy, depths to 18" and ¼" to 1⅞" diameters. 5 interchangeable pulleys for speeds of 4,600 to 42,500 r. p. m.



NO. 5 WITH B QUILL
$182.50 F.O.B. FACTORY

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For other examples of grinding methods, ask for the new "Here's How!" Book.

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TO HELP YOU

in designing basic parts for quantity production

Written by seven authorities, this book gives a completely practical treatment of the design of basic parts for quantity production by die casting, sand casting, screw machine, stamping, die forging, hot and cold heading and plastic molding. Along with full explanations of the various high-production processes and sound pointers on designing for each one of the processes, the book gives many specific rules, amply illustrated to show their practical applications for designing products that will lend themselves to rapid and economical mass production. In Part II various types of products manufactured in quantities at moderate or minimum cost are compared, one against the other, in many instances with actual production costs and tabular comparisons, to show the type of design best adapted to economical manufacture in various specific instances.

Handbook on Designing for Quantity Production

Prepared and Edited by HERBERT CHASE

Associate Editor of *Aviation*, assigned to *Wings*

517 pages, 5½x8½, 351 illustrations, 54 tables and charts, $5

Now you can avoid the necessity for redesign. Not only will you be able to form the original design quicker, but now you can be sure to make it thoroughly useful for more economical production in large quantities. We ask that you use the book once, for an invaluable design pointer on materials, for exact design considerations—actual advantages and drawbacks—for the various high-production processes, or for one of the hundreds of newly advanced, straightforward rules to follow in designing basic parts for the different quantity production processes. Use it once, and then decide whether this book will remain right at your fingertips for instant reference.

Chapters

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2. Design of Sand Castings for Quantity Production
3. Design of Screw Machine Products
4. Design of Stampings
5. Design of Die Forged Parts for Quantity Production
6. Notes on and Accomplishments in Hot Heading
7. Notes on the Design of Cold-headed Parts
8. Design of Plastic Moldings for EconomicalQuantity Production
9. Die Cast or Sand Cast
10. Permanent-mold and Die Castings Compared
11. Which Type of Nonferrous Casting?
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Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

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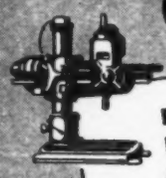
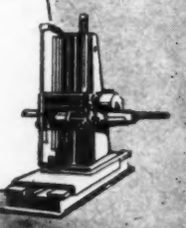
GILBERT



PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



DETAILS ON REQUEST

THE CINCINNATI GILBERT MACHINE TOOL CO.
CINCINNATI, OHIO

ABRASIVE

ACCURACY BOOSTS PRODUCTION

No. 1G	INTERNAL GRINDER	**No. 34**	VERTICAL SPINDLE SURFACE GRINDER
No. 1½	HAND FEED SURFACE GRINDER	**No. 3B**	AUTOMATIC FEED SURFACE GRINDER

Look for Our Full Page Advertisements

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND

You'll want to read about this

NEW BORING UNIT

... a new Baker 60-HO Vertical— arranged for a new method of boring

RIGIDITY is an important feature of this new heavy duty BAKER unit. It is now in use on rough boring operations in the center section ("banjo" housing) of a popular truck axle. Extra large spindles are driven by an enveloping worm and worm gears mounted at the lower end of the spindle. The spindles, measuring 6¼" in diameter are set in preloaded ball bearings. Heads on the saddles are designed for flexibility in speed changing. Speed changes for the heads are made with pick-off gears. For adjustment of the range of spindle speeds the ratio of the vee-belt driving sheaves is changed. The machine is furnished with special quick-acting fixtures, locating the housing from jaws around the center of the housings. The jaws are hydraulically operated. The unit is also equipped with a fixture to raise and lower the axle housings and a special cutter head, mounted direct to the spindle end without any extra tool supports.

Write, describing your special requirements. There is a BAKER machine to fit them!

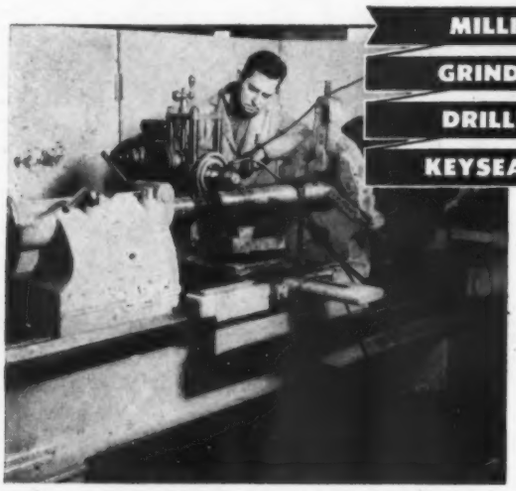
BAKER Bros., Inc.

Single and Multiple Spindle Machines for Drilling, Boring and Tapping TOLEDO 10, OHIO

CAN YOU MILL A KEYWAY 2 ½ IN. WIDE ON BOTH ENDS OF A SHAFT 20 FT. LONG, 10 IN. DIAMETER?

MASTER LATHE CONVERTER DOES IT IN ONE SET-UP!

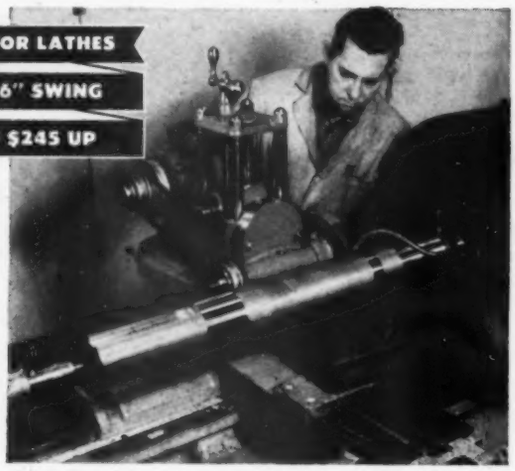
You can do it too if your lathe will accommodate work that large



MILLING
GRINDING
DRILLING
KEYSEATING

The Master Lathe Converter mounted on tool post carriage of a 27" lathe milling a keyway on a 4½" diameter shaft at the rate of 1½" per minute, using the power feed of the lathe.

3 SIZES FOR LATHES
9" TO 36" SWING
PRICES $245 UP



Grinding bearing surfaces with Master Lathe Converter and the Universal Grinding Head. Both Grinding and Milling, as well as turning operations, are done with one set-up of work piece in the lathe.

ANY LATHE IS A COMPLETE MACHINE SHOP IF YOU HAVE A MASTER LATHE CONVERTER

MASTER MANUFACTURING CO.
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This IS THE HAMILTON SENSITIVE TAPPING MACHINE

—especially engineered for the sensitive, accurate, **production** tapping of small holes. **Capacity**—From the smallest and finest tap to 10-32 inclusive. **Chuck**—Special Jacobs A1 0-¼ in. **Power**—⅛ H. P. **Speeds**—Approx. 1200-2600 R.P.M. **Size**—16" x 7" x 22". **Weight**—Approx. 75 lbs. Ample travel and clearances for all work within its range. Write for literature and prices. Address Dept. D-T.

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AMES *Precision* BENCH LATHE

Known for 40 years as a precision lathe of the highest quality. Bed 36" long. Ball bearing headstock uses 1" capacity collets. Swing 8⅜" over bed. Available with motor drive.

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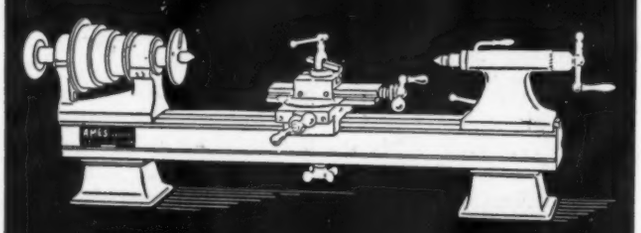


AMES PRECISION MACHINE WORKS
WALTHAM 54, MASS., U. S. A.

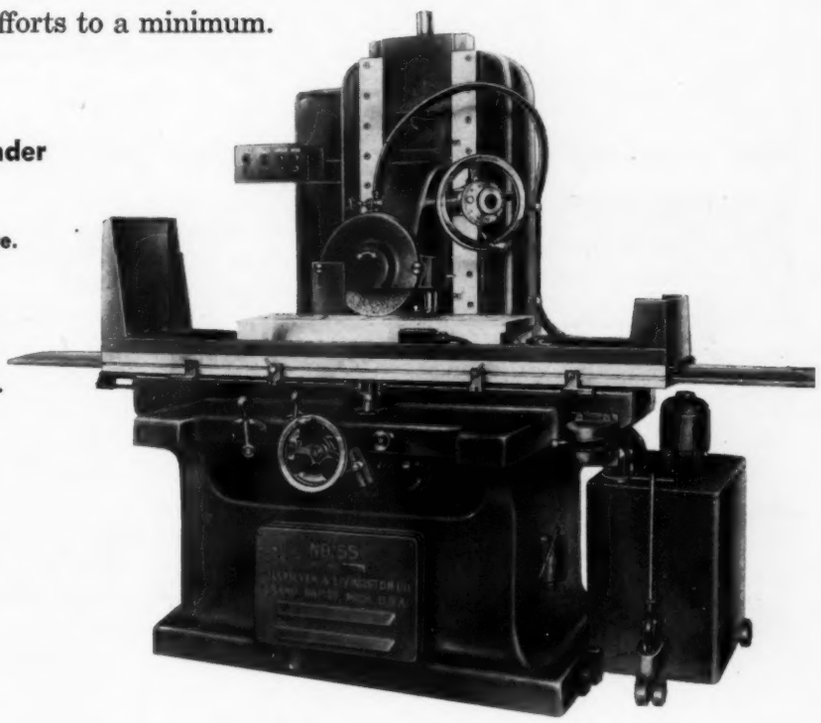
FASTER PRECISION PRODUCTION

125 feet per minute longitudinal table speed with G & L's GRAND RAPIDS No. 55 Surface Grinder

Only GRAND RAPIDS Hydraulic Feed Surface Grinders provide such exceptional table speed. Both the longitudinal table travel and the cross feed are automatic, hydraulically actuated. The wheel head is powered for rapid vertical travel. Automatic and powered movements of the Grand Rapids 55 cut the operator's efforts to a minimum. Magnetic chucks are available.

The Grand Rapids No. 55 Surface Grinder combines ALL these advantages:

- ★ **Longitudinal table speed of 125 feet per minute.**
- ★ **Integral cast column and base assures permanent alignment of vertical head ways and cross saddle ways.**
- ★ **Starters, controls and motors easily accessible.**
- ★ **Two spindle speeds, reduce wheel costs.**
- ★ **Patented vertical movement of wheel head.**
- ★ **Bijur one-shot lubrication system.**
- ★ **Special G & L spindle motor end-bells and over-size precision ball bearings.**
- ★ **Vickers vane type hydraulic pump.**
- ★ **Portable, self-contained motor-driven coolant system.**



SPECIFICATIONS:
Automatic Table Travel—longitudinal 38″, transverse 13½″.
Working surface of table—12″ x 36″.
Standard wheel size—12″ x 1″ x 3″.
Vertical movement of wheel head—18″.
Spindle speeds—1925 and 2500 RPM.
Floor space—150″ wide x 102″ deep.

Write for catalog GL 101

What "GRAND RAPIDS" Quality Means: G & L cast their own close-grained gray iron, machine all parts to micrometric tolerances, and precision-assemble grinding machinery of unsurpassed performance. *Grand Rapids* means *top* quality in Hydraulic Feed Surface Grinders.

GALLMEYER & LIVINGSTON COMPANY, 330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

TROXIDE

SOLVES PICKLING PROBLEM FOR MANUFACTURER OF FIRE-EXTINGUISHERS

A nationally known manufacturer (name on request) prefers and *uses* Troxide . . . after testing both the conventional acid solution and a Troxide solution in treating cold-drawn, heat-annealed steel cylinders. Here is why:

Using conventional acid solution	After changing to Troxide solution
Compelled to dump acid solution every twenty-four hours ... required two men for mixing and dumping.	Troxide solution dumped every two weeks . . . one man required for mixing and dumping.
Acid mist affected machinery, and spillage attacked floor . . . dangerous to workers.	No acid hazards with Troxide . . . no special clothing required for handling cylinders.
As acid strength diminished, pronounced etching was noted, ruining cylinders.	No etching occurred with Troxide. Action on good metal lessened uniformly with solution strength.

Conclusions

- **TROXIDE lasted 14 times as long as the conventional acid solution.**
- **TROXIDE saved manpower.**
- **TROXIDE saved metal.**
- **TROXIDE reduced rejects.**
- **TROXIDE protected workers and equipment from the dangers of acid mist.**
- **TROXIDE SAVED MONEY.**

Perhaps Troxide can do the same for you. What is your pickling problem? Let us solve your bright-dip problem, also. Just write "Troxide" on your business card and mail today.

TROXIDE

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—an idea of the relationship of plastics to metals and other material

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IN HEAVY DUTY DRILLING!

Big and powerful—the new Defiance No. 540 Vertical Hydraulic Feed Machine offers advantages in *speed, accuracy* and *efficiency* for heavy duty single or multiple spindle drilling, boring, reaming, or milling operations.

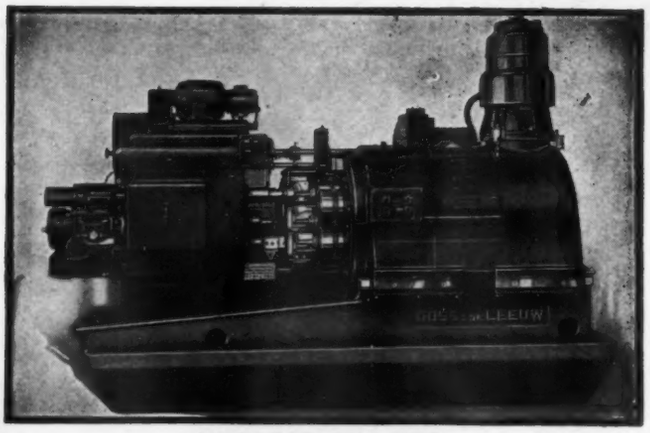
The machine shown here has a 28-spindle head and fixture for drilling 11/16" holes in large diameter plates ¾" and ⅜" thick. For this operation, the machine has a 42" three station indexing table. The column is a heavy-type cored casting with long ways which carry the head slide. Weight of machine, 39,150 lbs.

Built with the know-how of 96 years . . . traditional Defiance accuracy and dependability. Write for bulletin. Defiance Machine Works, Inc., Defiance, Ohio.

DEFIANCE

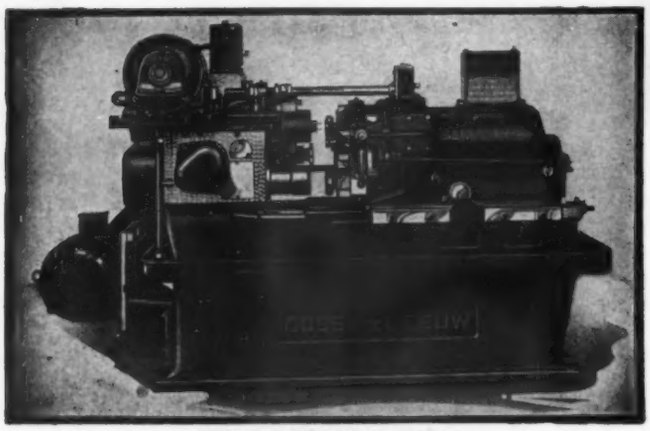
96 YEARS OF PRECISION MANUFACTURING

GOSS & DE LEEUW
Multiple Spindle
CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

for Continuous
HIGH DUTY PRODUCTION

Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾" N.C. and 1¼" N.C. Threads in alloy steel offers these features:

Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

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MANITOWOC, WISCONSIN

COMPLETE INFORMATION UPON REQUEST

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Made in nine sizes
No. 80 Wire Gauge to 1 inch

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MANUFACTURING CO.
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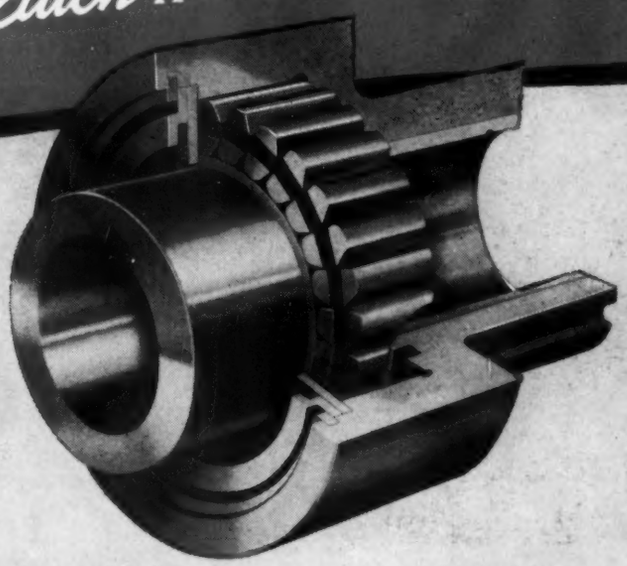
Automatic DRILLING - BORING MILLING - TAPPING *Units*

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
Indianapolis, Ind.

High Torque Capacity in a SINGLE UNIT with FORMSPRAG the FULL COMPLEMENT Over Running Clutch..



Formsprag Design Insures SUPERIOR PERFORMANCE

The performance of FORMSPRAG, in widely diversified industries, offers testimony to Gear-grind's sound engineering, precision manufacture and proper application.

Full Complement of Sprags

With the annular space between driving and driven members *completely filled* with sprags, there is no need for cages to position them. Torque load is distributed over the greatest possible number of sprags. Longer life is the result.

High Torque Capacity

Formsprag is available in many sizes, providing torque load capacities from 20 to 10,250 foot pounds. Formsprag offers the highest possible capacities for size, weight and space required for installation.

Simple Construction

Cylindrical inner and outer races on which no localized wear can develop. No internal or external cams. No cages. End notches shaped to retain energizing spring and protect sprag gripping surfaces against concentrated end load. Easy installation.

Positive, Instantaneous Action

No lost motion. No backlash. No slipping. Over-runs freely, at the slightest reduction in the speed of the driving member. Engages smoothly and positively.

Write for Literature

Upon request we will send you illustrated literature, specification sheets showing capacities and dimensions of both plain and ball-bearing types. To serve you best, let us have a description of your operation, normal and maximum torque at specified speeds, number of times a minute the clutch engages and disengages, space limitations and other pertinent information.

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

HOEFER MILLING HEADS

Counterbore

24 . . . 2½" DIA. HOLES IN 7.8 SECONDS . . . . .

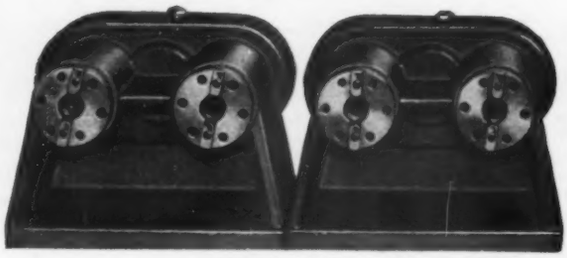
COUNTERBORING TRACK LINKS

2½ in. diameter by ⅜ in. deep holes. Speed 40 feet per minute — 61 r.p.m.

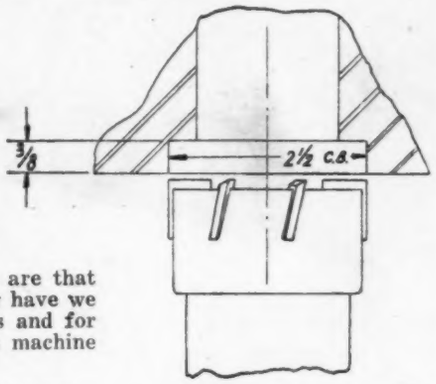
6 tooth cutter cuts .048 in. per revolution.

2.928 feet penetration per minute.

⅜ in. depth — 7.8 seconds actual machining time for both counterbores.



Two of a group of twelve two-spindle milling heads arranged for mounting of counterboring milling cutters with standard key drive for counterboring Track Links. The spindle construction is that of standard milling machine type.

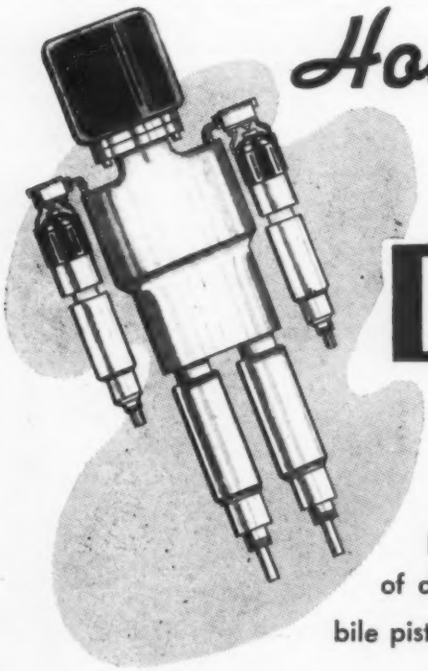


Write and tell us of your needs and we will make recommendations.

NO matter how difficult your problem may seem to you the chances are that we have furnished Multiple Spindle Heads for similar use. Not only have we built heads for mounting on drill presses but also on rotating spindles and for mounting on the turret of turret lathes motivating them through the machine spindle containing the work.

Hoefer Heads not only increase production per hour but decrease cost of drilling or allied operations . . . also they increase production from the same floor space (no new machinery needed) and decrease handling time.

Hoefer's Whole Business is Holes . . . . **HOEFER MFG. CO.** *Freeport, Ill.*



How many uses

HAS A ROBOT?

FRANKLY—WE DON'T KNOW.

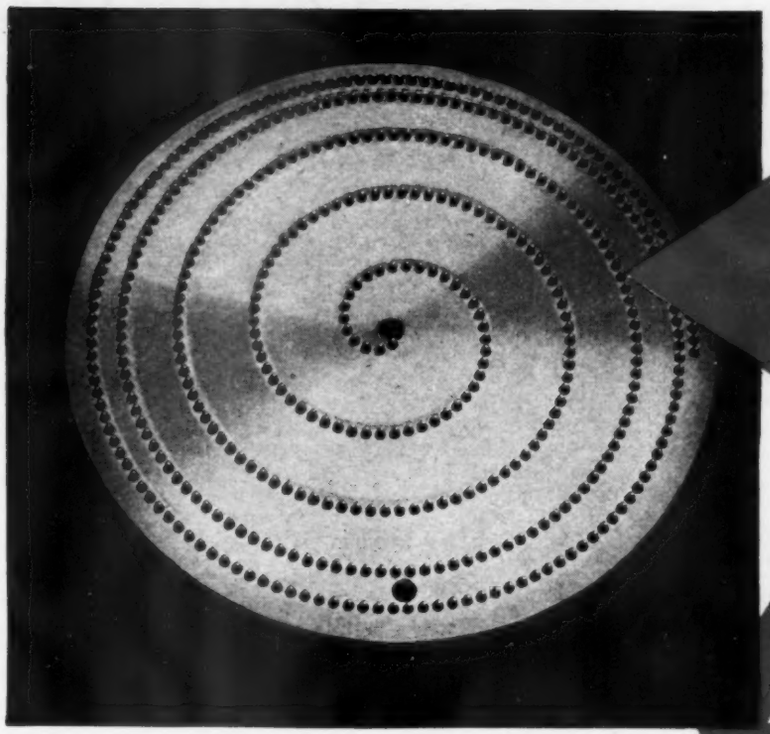
ROBOTRILL HEADS

New uses are being found daily. One recent installation speeds up production and reduces the cost of drilling smoke holes in automobile pistons.

Our engineers will welcome the opportunity to suggest applications that will cut your production drilling costs to a minimum.

Retool with ROBOTOOLS, Inc.

DEXTER • MICHIGAN



Demonstrating SIP *Precision!*

437 HOLES!

"...one of the most intricate jobs we have done", says

FAIRCHILD CAMERA AND INSTRUMENT CORP.

The part is a sine cam for an automatic computer, a flat aluminum disc upon which extruded gear teeth form a spiral path. A SIP Jig Borer was used for boring the 437 holes in the dies for extruding these teeth, and for boring similar holes in the gage on which the extruded work was checked.

The spiral tooth position was held to within ±.0005" in radial location and to within 30 seconds of the computed location in angular position, tolerances not accumulative. Unusually high precision? Yes, but it is a typical example of the precision and convenience of operation of SIP Jig Boring Machines in connection with SIP Circular and Tiltable Tables. In fact, the SIP Jig Borer is one of the few existing machines capable of working to such extreme limits of accuracy. Whenever the highest precision is needed, achieve it with a SIP Jig Borer. We would be pleased to have your engineers consult with us.

RANGE OF TABLE SIZES

No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
Hydroptic-B (illustrated)	39½" x 32"
No. 5G	43⅜" x 32"

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- how to select and heat treat the right tool steel for the job
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- save time and money in the toolroom
- the relation of design to heat treatment
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Vice-President of
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Criterion Boring Heads are particularly adapted to the use of carbide tools due to their extremely rigid construction. Their accuracy, utility, and interchangeable feature rate the highest praise from operators everywhere. Lead Screw ground from solid AFTER hardening. Order from your dealer. Request free literature.

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MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

Hydratrol Lathes

HEAVY DUTY TYPE

"THE BEST LATHE EVER MADE!"

SAYS AUSTRALIAN MFR. OF PRECISION PLASTICS

THE above photo, taken in the plant of E. W. Tilley, Melbourne, shows a 24" Heavy Duty HYDRATROL LATHE. The operator is turning dies for use in the production of Precision Plastics. A steel billet is shown, ready to go into the lathe.

In a recent letter, this concern said: "We have had lathes from all nations in use these twenty-five years, but your lathe is certainly something to be proud about.

"We have found that the design is really marvelous, and has been carried out to perfection.

"I, and all my business friends that have seen this Hydratrol Lathe working, agree that it is the best engine lathe ever manufactured."

Let us show you what a Heavy Duty HYDRATROL LATHE could do in *your* shop. Sizes 20" to 36". Also Large Hollow Spindle Type—sizes 18" to 36".

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND • SAINT LOUIS 3, MISSOURI

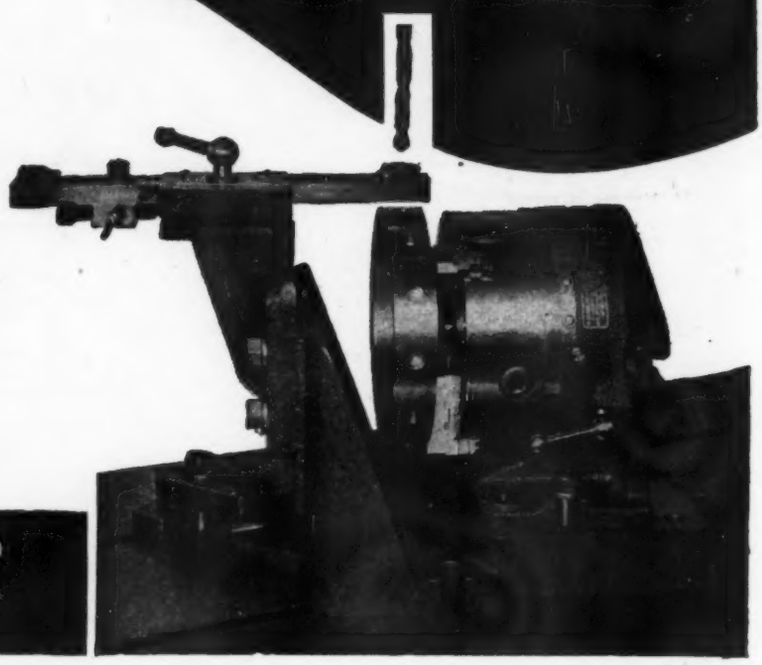
RADIAL DRILLING OPERATIONS INVOLVING INDEXING . . . . . *are speeded up with the* HARTFORD SUPER-SPACER

The range of jobs possible with the Hartford Super-Spacer is greatly extended through the use of attachments specially designed for specific operations. Shown here, the Super-Spacer is equipped with a radial drilling attachment, secured to a supplemental base of the device. This arrangement provides for variations in length and diameter in radial drilling with a minimum time required for setting up work. Indexing is fast and accurate. Mask plates which are a feature of the Super-Spacer remove all possibility of error in indexing.

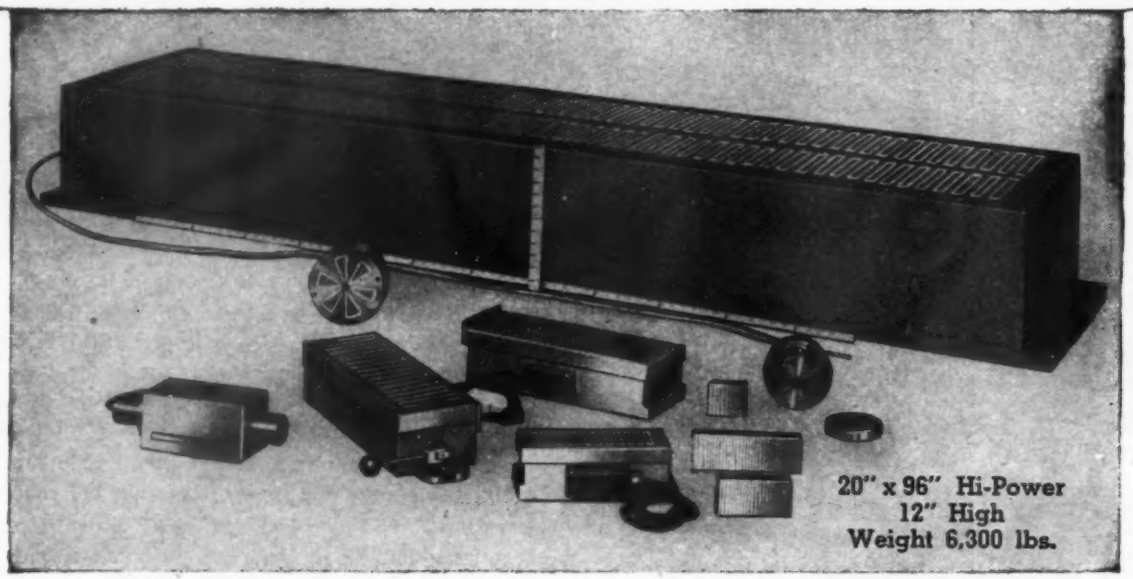
The Hartford Super-Spacer provides a substantial and accurate indexing foundation at minimum cost for special fixtures, a number of which are available for use with the Super-Spacer. These attachments provide easy and quick set up for a surprisingly large number of indexing operations.

You will be interested in the many time-saving applications illustrated in literature available on request.

Write today for further information.



The HARTFORD
SPECIAL MACHINERY CO.
Hartford 5, Conn.



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12" High
Weight 6,300 lbs.

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- Increase your Productive Efficiency by the use of WALKER MAGNETIC CHUCKS.
- Less fatigue on the part of your operating personnel.
- Submit your problems to WALKER engineers for successful solution.

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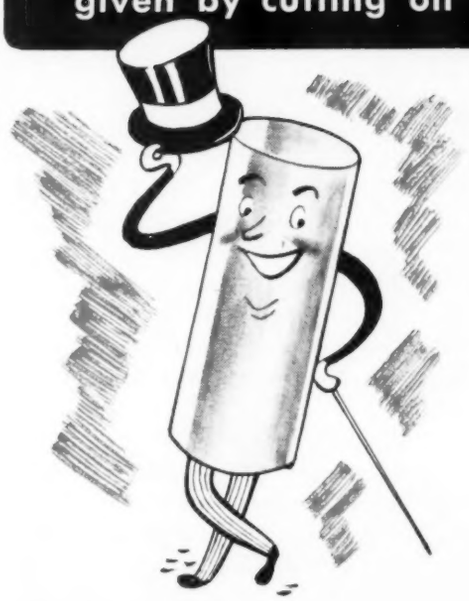
100 ROCKDALE STREET - WORCESTER, MASSACHUSETTS
Makers of Rectangular, Swivel and Rotary Magnetic Chucks. Also Permanent Chucks.

Can this versatile cutting fluid solve a problem for you?

STANICOOL HD

. . . has the cooling ability of a water emulsion

. . . gives finish and tool life approaching that given by cutting oil



Do you have some machining operations that don't seem to fit any cutting fluid you try? When cutting oils are used, tools and work overheat. When water emulsions or soluble oils are used, tool life and finish are poor. Stanicool HD Soluble Oil has taken over many jobs like this and has saved tools, parts, and machining time.

It has other qualities, too, that make it easy to work with:

- **It's easy to mix.**
- **Does not gum up machines and work.**
- **Is non-irritating to operators' hands.**
- **Is stabilized against odor development.**
- **Has anti-rust qualities.**

A Standard Cutting Oil Specialist will analyze any metal cutting operation that is troubling you and will recommend the cutting fluid you need. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

An improved gear lubricant that can be sprayed on gears...

One method of spraying gears is pictured above. Grease under pressure in the tank is carried to the spray gun in the large hose. A separate air hose to the gun provides pressure to break up the grease into a fine spray.

CALUMET Viscous Lubricant

- Saves time in application
- Gives smooth, even film
- Reduces frequency of application
- Reduces throw-off

Calumet Viscous Lubricant is not the old type of gear shield usually made from residual products of petroleum. It is a true grease, manufactured from selected soaps and oils plus additives to secure the qualities most needed in a gear shield. In addition, a range of grades is provided, to meet all plant conditions under which gears operate.

That is why Calumet Viscous Lubricant gives the advantages listed above. Because all grades can be applied without heating, and all except the heaviest grade can be sprayed, it cuts application time to the minimum. Spraying also gives a smooth, even coating of lubricant, eliminating bare spots or excessive deposits which may drop off before the lubricant is worked into the gears.

An additive in the lubricant gives it improved wetting ability—that's the ability to adhere closely to the metal—so as to give better resistance to water and heat.

Let this wear-reducing lubricant protect your plant gears. A Standard Oil Lubrication Engineer will survey your plant and help you determine the grades you need and the most economical methods of application.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

A HIGH PRODUCTION

SPECIAL PURPOSE MACHINE TOOL

Unsurpassed

MODEL A
⅛" Capacity

FOR *Multiple* DRILLING
" MILLING
" TAPPING
" BORING
" TURNING

• PACIFIC AVIATION engineers are prepared to demonstrate the Hydromat and how it can effect the highest, most efficient, and most economical production in your field. This new development is a competition pacemaker that the modern manufacturer cannot afford to be without. Investigate tomorrow's drill head today. Lead in high production volume and profits with HYDROMAT!

Exclusive

FEATURES	APPLICATIONS
Air-hydraulic feed, infinitely variable.	Special purpose high production machine tools.
Drills holes from No. 80 drill up to 3" diam., bores up to 6" diam.	Sensitive drill presses.
No gears or cams to change.	Power operated floor and radial drill presses.
Any required length of feed.	High speed tapping machines.
Deep hole step drilling easily accomplished through air valving.	Boring machines.
	Turning operations.

HYDROMAT ACCESSORIES

Hydraulic clamps and brackets for positioning drill heads.
Table units for mounting drill heads—square, round, oblong, or to order. With or without cooling systems.
Electrical cycling units for deep hole drilling.
Sensitive drill press.
Floor type drill press—¾" capacity, 5" stroke. Hydromat and hand feed. Micrometer depth adjustment.
Electric pre-set control system for multiple operations.
Complete line of traverse tables, rotary tables, clamping fixtures for manufacturer's assembly of special purpose machine tools.

Investigate tomorrow's drill head today! Write for booklet.

PACIFIC AVIATION, INC.
9900 LINCOLN BOULEVARD
LOS ANGELES 45, CALIFORNIA

THE *New* HYDROMAT DRILL HEAD

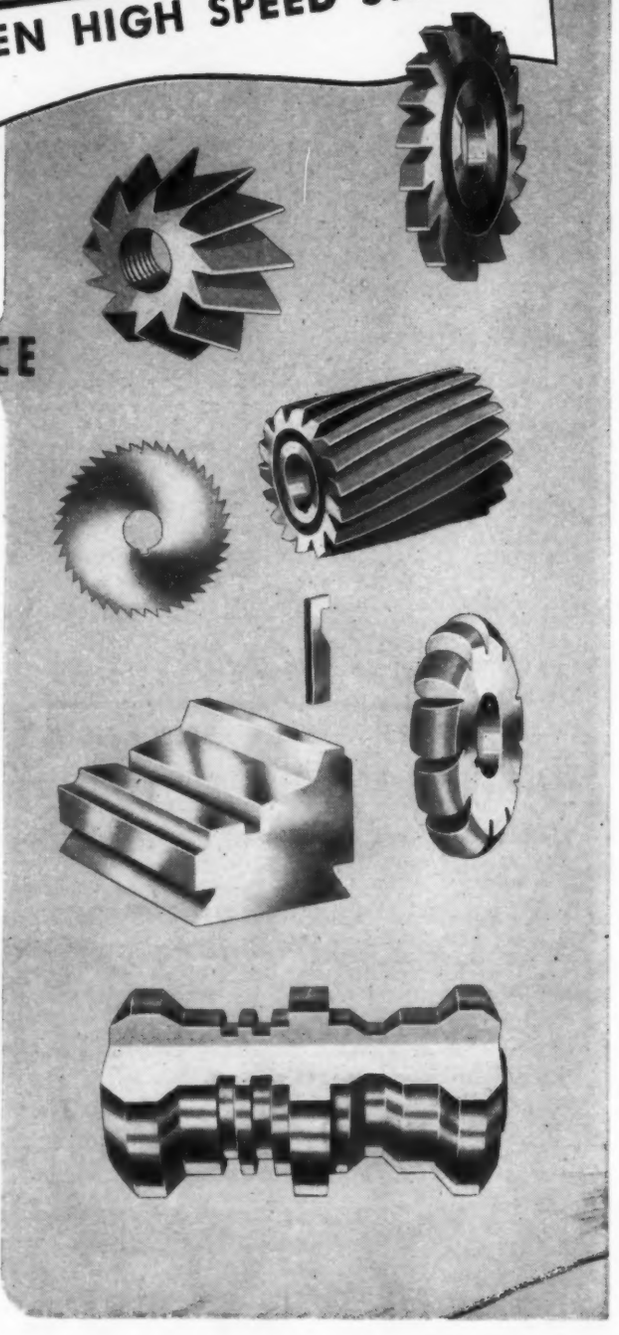
Specify one of these

MO-MAX

MOLYBDENUM—TUNGSTEN HIGH SPEED STEELS

for

BETTER TOOL PERFORMANCE



"LMW".....ALLEGHENY LUDLUM STEEL CORP.
"MOHICAN".....ATLAS STEELS LIMITED
"BETHLEHEM HM"....BETHLEHEM STEEL COMPANY
"MO-CUT".....BRAEBURN ALLOY STEEL COMPANY
"STAR MAX".....CARPENTER STEEL COMPANY
"MOLITE M-1".....COLUMBIA TOOL STEEL CO.
"REX T-MO".....CRUCIBLE STEEL CO. OF AMERICA
"DI-MOL".....HENRY DISSTON & SONS, INC.
"HI-MO".....FIRTH-STERLING STEEL CO.
"REX T-MO".....HALCOMB STEEL COMPANY
"MOGUL".....JESSOP STEEL COMPANY
"TATMO".....LATROBE ELECTRIC STEEL CO.
ST. LAWRENCE ALLOYS, INC.
"S. T. M.".....SIMONDS SAW & STEEL CO.
"MO-TUNG".....UNIVERSAL-CYCLOPS STEEL CORP.
"8-N-2".....VANADIUM-ALLOYS STEEL CO.
"VUL-MO".....VULCAN CRUCIBLE STEEL CO.

For the full story on MO-MAX high speed steels—their physical properties, their advantages, and how to heat treat them—write today to Department E for the new, revised MO-MAX Handbook.

★ ★ ★

THE CLEVELAND TWIST DRILL CO. • 1244 East 49th Street • Dept. E. • Cleveland 14, Ohio

NEW!

DISSTON SAFETY REEL

FOR FLEXIBLE-BACK METAL-CUTTING BAND SAWS

An important handling problem solved by a Disstoneer

1. Grip clip between thumb and forefinger of left hand . . .

2. Pull out band saw with right hand . . .

3. Cut off length desired . . .

4. Push clip back to end of saw. The entire operation takes but a fraction of a minute—and it is *safe.*

Anyone who has ever handled a band saw coil knows that the operation can be as dangerous as uncoiling a snake. With the slightest fumbling the whole roll may suddenly spring to life, go "haywire" and get completely tangled up and injure the operator. The job of coiling it up again is one not soon forgotten.

"Something should be done about it!" A Disstoneer* said that. Following his suggestion the Disston Safety Reel for flexible-back metal-cutting band saws was developed . . . changing a difficult and dangerous operation into one that's almost as simple as pulling out a length of metal tape rule . . . and with equal safety.

Another clear cut case of Disston leadership

ESTABLISHED 1840
REG. U.S. PAT. OFF.

HENRY DISSTON & SONS, INC.
620 Tacony, Philadelphia 35, Pa., U. S. A.

***DISSTONEER**—a man who combines the experience of Disston leadership and sound engineering knowledge, to find the *right tool* for you—to cut wood, to cut metal and other materials—and TO CUT YOUR COST OF PRODUCTION—*not only on special work but on ordinary jobs as well.*

The Disston Safety Reel for flexible-back metal-cutting band saws holds 100 feet of band saw. This is enclosed in a tough container which protects the saw and makes storage easy. All widths up to and including ½" are supplied on the new Safety Reel.

MAIL COUPON FOR FURTHER PARTICULARS

HENRY DISSTON & SONS, INC.
620 Tacony, Philadelphia 35, Pa., U. S. A.

Please send full particulars regarding the new Disston Safety Reel for flexible-back metal-cutting band saws.

NAME_____

POSITION_____

FIRM NAME_____

ADDRESS_____

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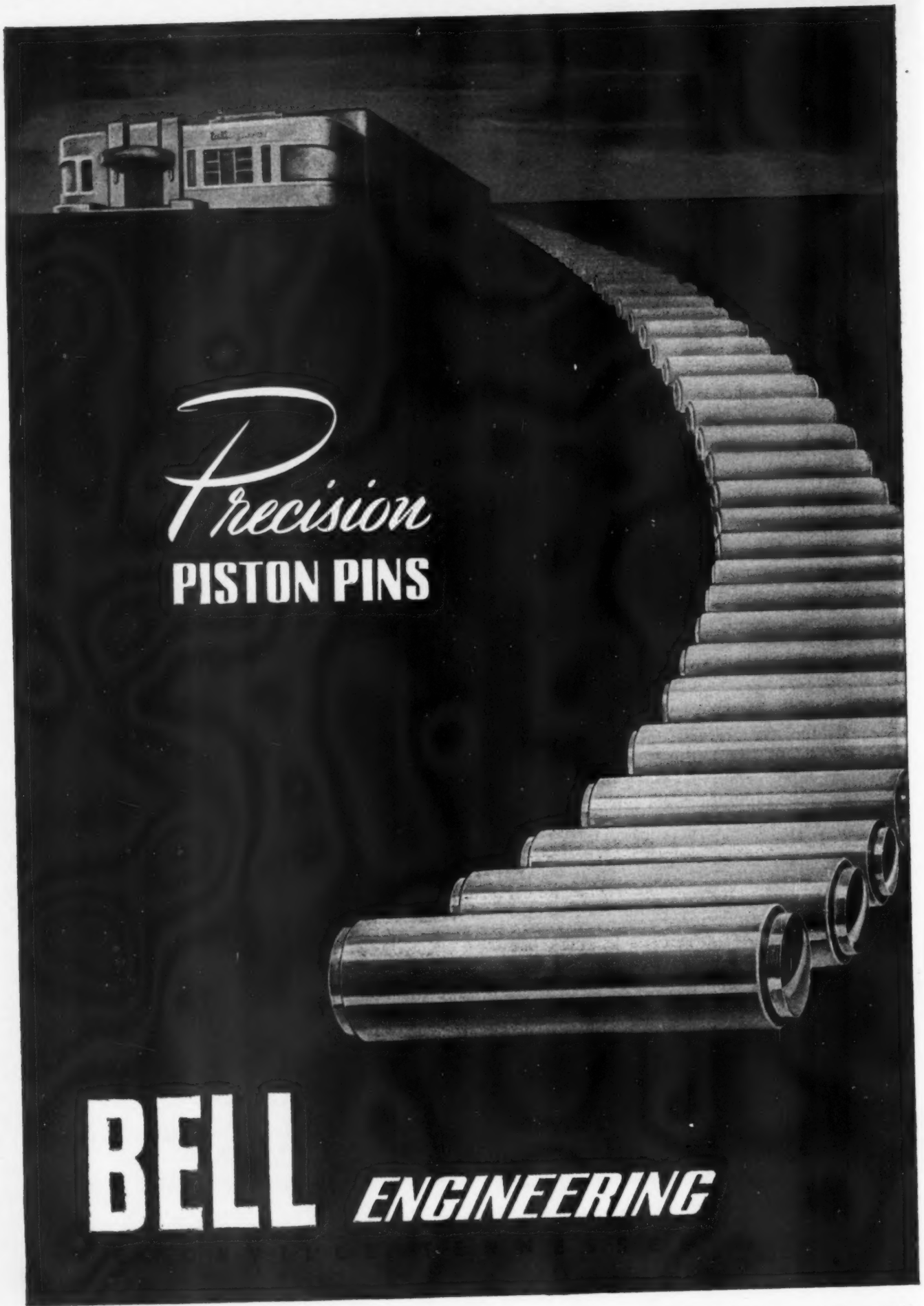

Precision
PISTON PINS
BELL ENGINEERING

CUT THE COST OF TUNGSTEN CARBIDE-TIPPED WORK REST BLADES

NEW SCULLY-JONES *Segment-Type** WORK REST BLADES will save you money because (1) a *damaged blade is no longer a lost blade,* and (2) only the individual *damaged segment* needs to be replaced.

New Segment SLOTS (an exclusive feature) are self-clearing and so designed that metal chips and grit are quickly carried away by the circulation of the coolant. Thus, with slots constantly free of accumulation, chips do not collect to mar the work being ground.

This *Segment-Type** Design makes it possible to use a harder, longer-wearing grade of carbide.

The cost of Scully-Jones reconditioning service on this *Segment-Type** Blade is but a fraction of the cost of a new blade.

Write for prices and delivery on this long-wearing, improved type of Work Rest Blade for Centerless Grinders.

SCULLY-JONES *SEGMENT-TYPE T.C.T. WORK REST BLADES**

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1913 SOUTH ROCKWELL STREET · CHICAGO 8, U. S. A.

1798

Simplify

WITH BETHLEHEM'S BIG 8 TOOL STEELS

The BIG 8 Family

Carbon Tool Steel
(water-hardening)

Tool Room (BTR)
(oil-hardening)

Omega
(maximum shock-resistance, cold work)

No. 67 Chisel
(high shock-resistance, both hot and cold work)

Air-Hardening
(low distortion during heat-treatment)

Lehigh Die & Tool, H Temper
(high-production die steel)

No. 57 Hot Work
(maximum red-hardness in hot work)

No. 66 High Speed
(general-purpose high-speed steel)

Because the Big 8 will do some 90 per cent of your tool-steel jobs—and do them superlatively well.

Because it is easy to learn their properties, their applications, their personalities.

Because there isn't a "fussy" steel in the group.

It all boils down to this:

The average toolroom no longer needs to maintain a wide and confusing assortment of one-purpose steels. Not with Bethlehem's Big 8 in stock. The Big 8 group is small, compact . . . easy to heat-treat, easy to handle . . . and amazingly versatile.

Use these steels to the fullest advantage. Be sure you acquaint yourself with *all* their uses. That's your opening step in a program of simplified toolroom practice. *Write for your Big 8 Kit—a set of booklets on these versatile tool steels.*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

★ ★ ★ BETHLEHEM STEEL ★ ★ ★

Simple enough with a

WILLIAMS "SUPERRENCH"

Those difficult and exacting jobs, impossible with ordinary wrenches, usually are simple enough with "Superrenches". Williams "Superrenches" have a ferret-like ability to slip into nooks and crannies and swing buried nuts or make delicate adjustments. Their positive, slip-proof grip reduces hazards to workman and fine equipment alike. Available in a wide range of sizes and patterns . . . sold by leading Industrial Distributors everywhere.

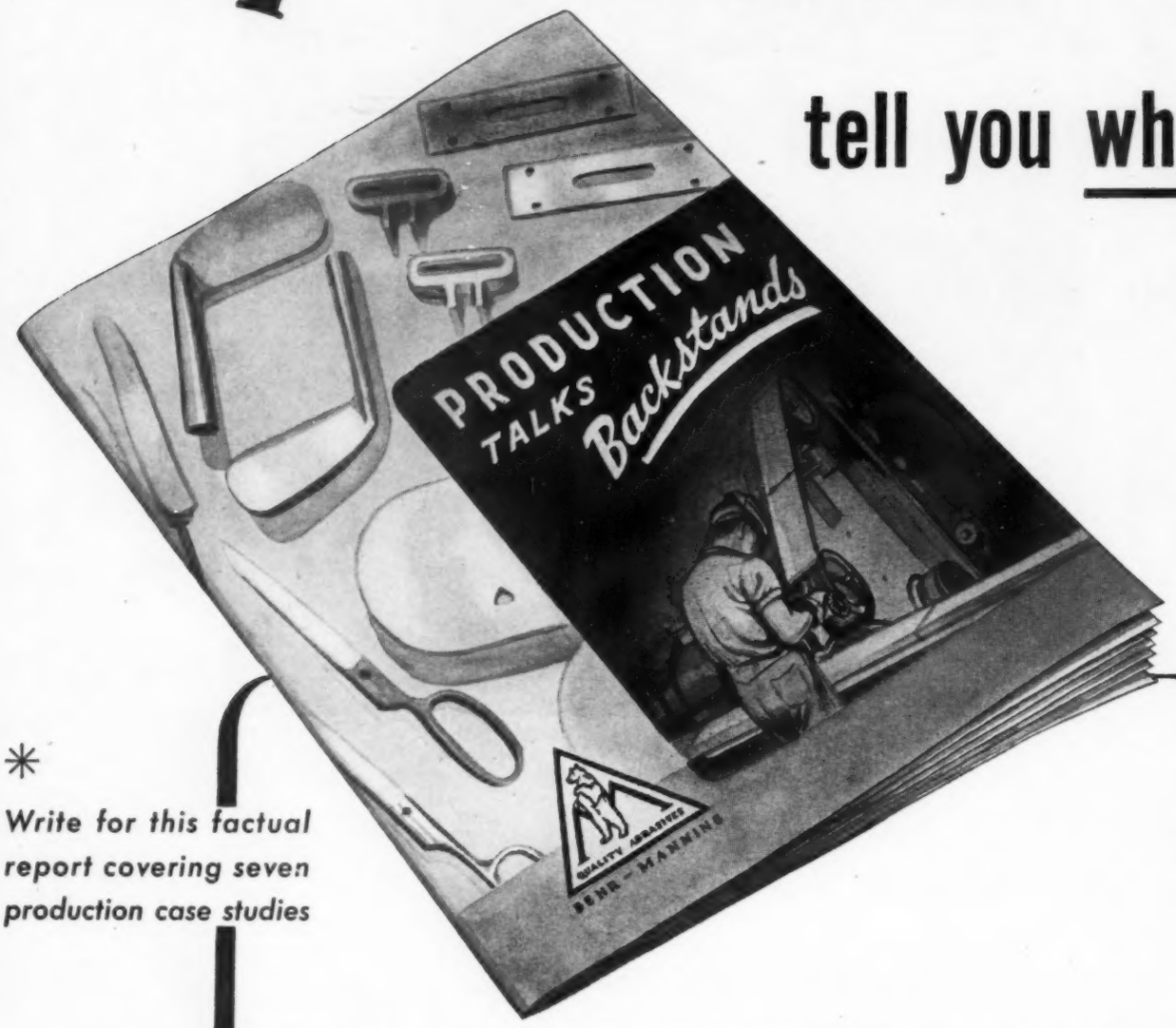
J. H. WILLIAMS & CO., BUFFALO 7, NEW YORK

WILLIAMS

DROP-FORGINGS AND DROP-FORGED TOOLS

7 Field Engineers

tell you why*



* *Write for this factual report covering seven production case studies*

Easily the greatest current development in coated abrasive engineering is the conversion of grinding and finishing methods from shop-coated set-up wheels to factory-coated abrasive belts through the use of idler backstands and cushioned work wheels. Truly, "production talks backstands"!

Here is a booklet for production men that answers the question, "Can backstands boost our production, too?" Factually written from field engineers' case reports on backstand installations in seven diversified industries, it permits accurate appraisal of backstand adaptability by direct comparison.

Production men recognizing comparable backstand operations in this booklet may rightly expect equivalent success with backstands in their own plants.

BEHR-MANNING (DIVISION OF NORTON COMPANY) **TROY, N.Y.**

Quality Coated Abrasives Since 1872

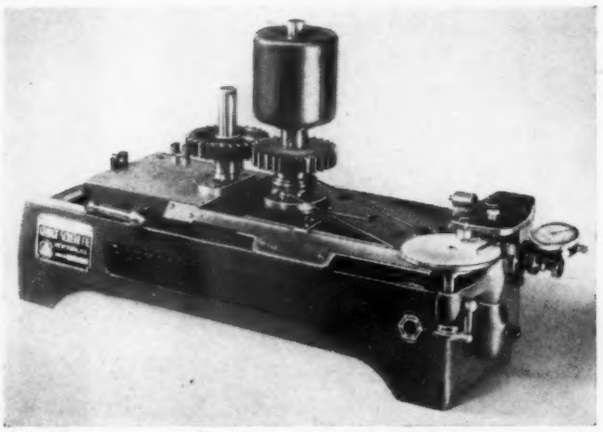
SCHERR

TIME and MONEY-SAVING SPECIALTIES

will aid your shop back to normal and profitable production. Many of the items missed for years are back again. Send for illustrated bulletins of products listed below:

WILDER PROJECTOR

Throws a magnified image of an actual part against an enlarged master drawing, instantly showing if part is inaccurate, and how much. Permits control of a production job from start to finish—insures correctness of tool forms, checking of gages, correctness of tool adjustment at start of production, spot inspection to detect tool wear as work progresses. With the Wilder Projector, the last piece on the run as well as the first, will be well within tolerance limits. Operation of the Wilder is so quick and simple that many shops use it for 100% inspection. Priced within budget of any shop. Write for the bulletin. The gear testing fixture shown below can be used on the Wilder projector.



PARKSON GEAR TESTERS

For spur, spiral, worm and bevel gears. Recognized everywhere as the direct method to detect errors in gears right in the shop before costly rejections occur. Sensitive floating carriage riding on balls shows eccentricity of pitch line, in correct center distance and backlash, errors in toothspacing and involute, off-center condition of teeth, etc. Spinning two mating gears by hand on the stationary non-revolving arbors tells the experienced operator whether gears will run without vibration or noise.

A RECORDING ATTACHMENT using 4" diameter wax covered paper discs (no ink or liquids) can be furnished for reference should complaints come in after gears are built into a mechanism. Very often a gear is unjustly blamed when the wrong center distances in the housing, poor bearings, etc. may be the cause. **PARKSON GEAR TESTERS** are furnished in ten sizes for gears from 1/4" to 36" center distance. Write for full details.

Other SCHERR Production Aids

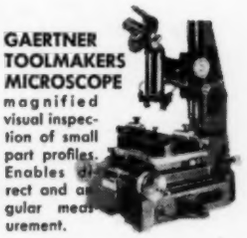
MAGNI-RAY magnifies and floodlights work under inspection.

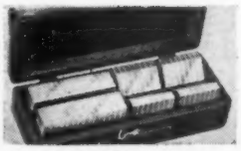
COMPARITOL visual, magnified readings to tenths without dependence on "feel" Used widely in volume inspection.

Space in this ad does not permit listing all of our important money- and time-saving shop necessities, some of them familiar but many of them brand new. Study the small cuts here and send for detailed description.

ALL PURPOSE GRINDING FIXTURE quick, simple and accurate way to grind correct angles on cutting tools.

GAERTNER TOOLMAKERS MICROSCOPE magnified visual inspection of small part profiles. Enables direct and angular measurement.





MAGNE BLOX—greatly increase usefulness of magnetic chucks, holding work vertical or at an angle, etc.

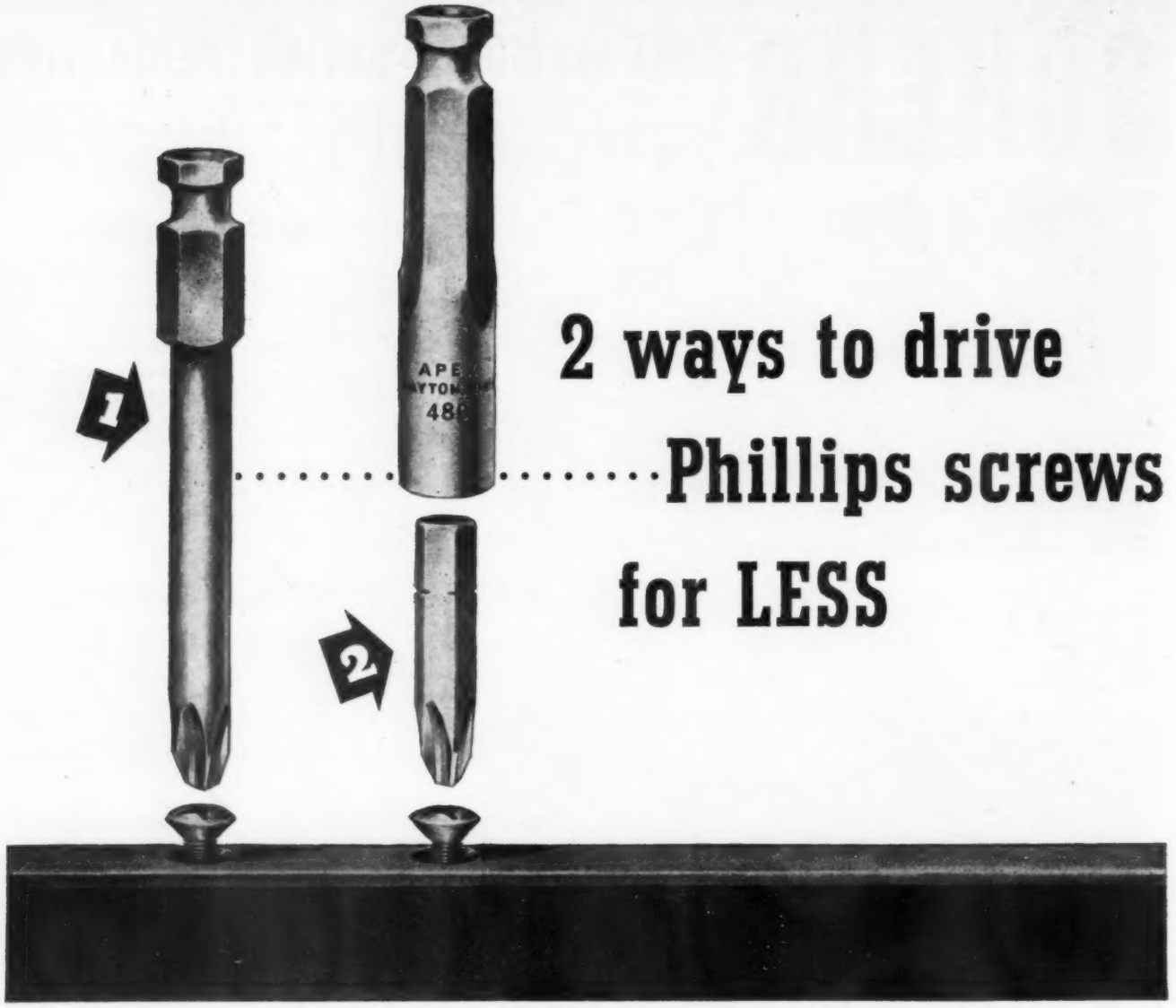
TACHOMETERS—and revolution counters. Extremely accurate in measuring surface speeds as well as rpm.

PRECISION CALIPERS of stainless steel. Also height gages to 48".

GEAR TESTING FIXTURE for small gears. Runout shows on the dial gage. Center distance set by micrometer.

ULTRA-CHEX GAGE BLOCKS accurate to .000008". Large and small sets, for all needs.

GEO. SCHERR CO., Inc. 201 LAFAYETTE STREET NEW YORK 12, N. Y.



2 ways to drive Phillips screws for LESS

... and they're both BEST!

1. Best for driving Phillips screws in close quarters, when you need a bit of minimum diameter. By returning worn bits to Apex for complete reconditioning, you can multiply service life many times — actually get eight lives per inch of bit. The cost: a fraction of the price of new bits. Shanks: for all your electric, pneumatic, or spiral drivers.

2. Best for driving screws where space permits the slightly larger OD of the Apex exclusive bit holder, with the replaceable insert tip. Once you get holders for your drivers, it's a cinch to stock *four sizes* of tips to fit practically all your bit holders and drive the full range of Phillips screw sizes. Tips float in holders, seat more easily in screw recesses, simplify bit inventory, give maximum service.

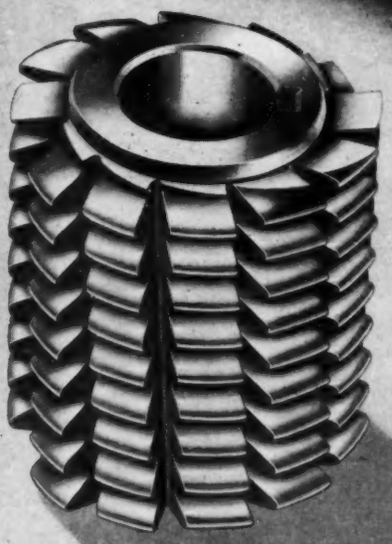
Write today for Catalog 15 on Apex standard power bits and Bulletin 102 on Apex insert type bits.

THE APEX MACHINE AND TOOL COMPANY, DAYTON, OHIO

APEX screwdriver bits

Safety Friction Tapping Chucks; Quick Change and Positive Drive Drill Chucks; Vertical Float Tapping Chucks; Parallel Floating Tool Holders; Power Bits for Phillips, Slotted Head and Clutch Head Screw Drivers; Hand Drivers for Phillips and Clutch Head Screws; Aircraft and Industrial Universal Joints; Sockets and Universal Joint Socket Wrenches.

FACTS about HOBS and GEAR CUTTERS



Call Your DISTRIBUTOR!

Leading distributors in every section of the country have complete stocks of National Cutting Tools. Every National distributor has a factory trained man to serve you. Call your National distributor for cutting tools or any staple industrial product.

Hobs are used for cutting various types of gears, such as spur, spiral, worm, and involute gears, and spline shafts, and for a number of similar applications, where large quantities are to be produced. Single type Gear Cutters are used for small quantity short run jobs where the expense of hobs are not warranted.

NATIONAL makes a complete line of gear cutters and hobs, for every application. All are of the same high standard that has made NATIONAL tools the National choice.

NATIONAL

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS
END MILLS

TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICH., U.S.A.

Tap and Die Division — Winter Bros. Co.

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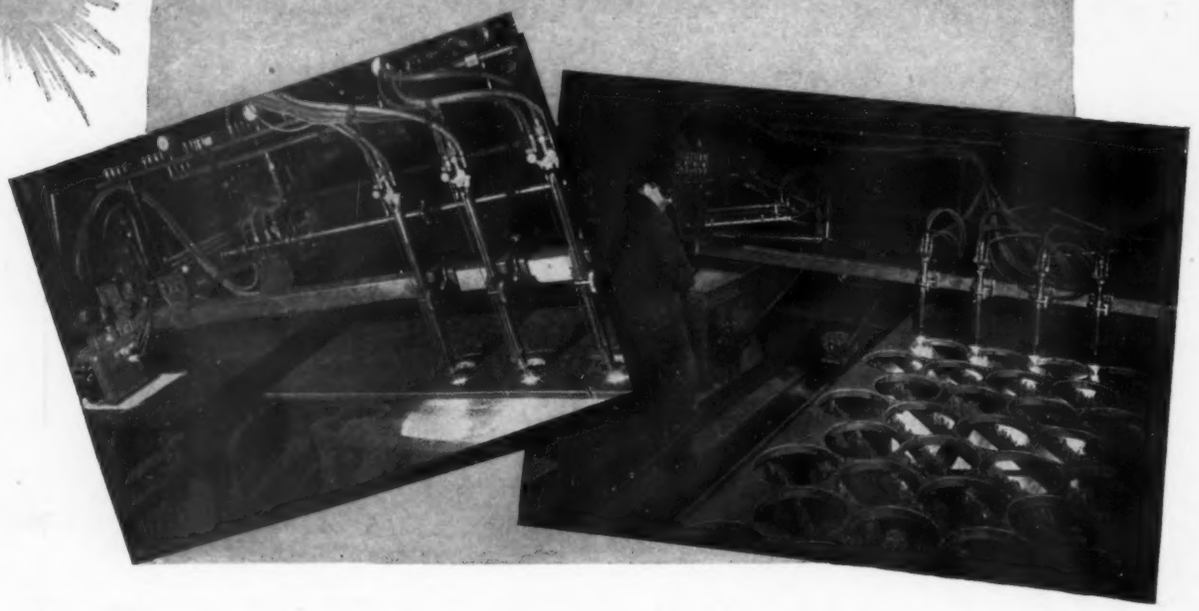
Indispensable Gas Cutting Machines That HELP YOU...

SMASH PRODUCTION SCHEDULES!



HERE ARE two Airco pantograph type cutting machines that are practically a "must" for plants and shops engaged in the modern process of steel fabrication. Both machines will cut steel plate, slabs, billets and forgings into any shape — in any quantity, faster . . . at less cost than any other known method.

The Oxygraph is a stationary machine, designed for operation with one or more torches for multiple cutting, "stack" cutting, or multiple "stack" cutting. Machine cutting ranges are: largest square 43" side; largest circle 52" dia.; longest straight line 133"; rectangles 3" x 131" to 33" x 40". This is one of the most popular shape cutting machines ever offered.

The Travograph is a machine having the same basic design as the Oxygraph, with the same cutting versatility. However, it is a mobile unit — mounted on a carriage which travels on steel rails. Maximum cutting widths are 6'. 10' and 12' 3", depending on the model. The cutting length is limited only by the length of the rails, installed in 16' sections.

To afford the greatest flexibility of operation with these machines, Airco offers three distinct types of tracing devices — manual, magnetic, or electronic. The recently introduced electronic device, popularly known as the "Electronic Bloodhound", requires only an outline drawing, or silhouette as a guide for the cutting of countless designs . . . from simplest to most intricate . . . inside and outside square corners, obtuse and acute angles, narrow slots, and innumerable other shapes.

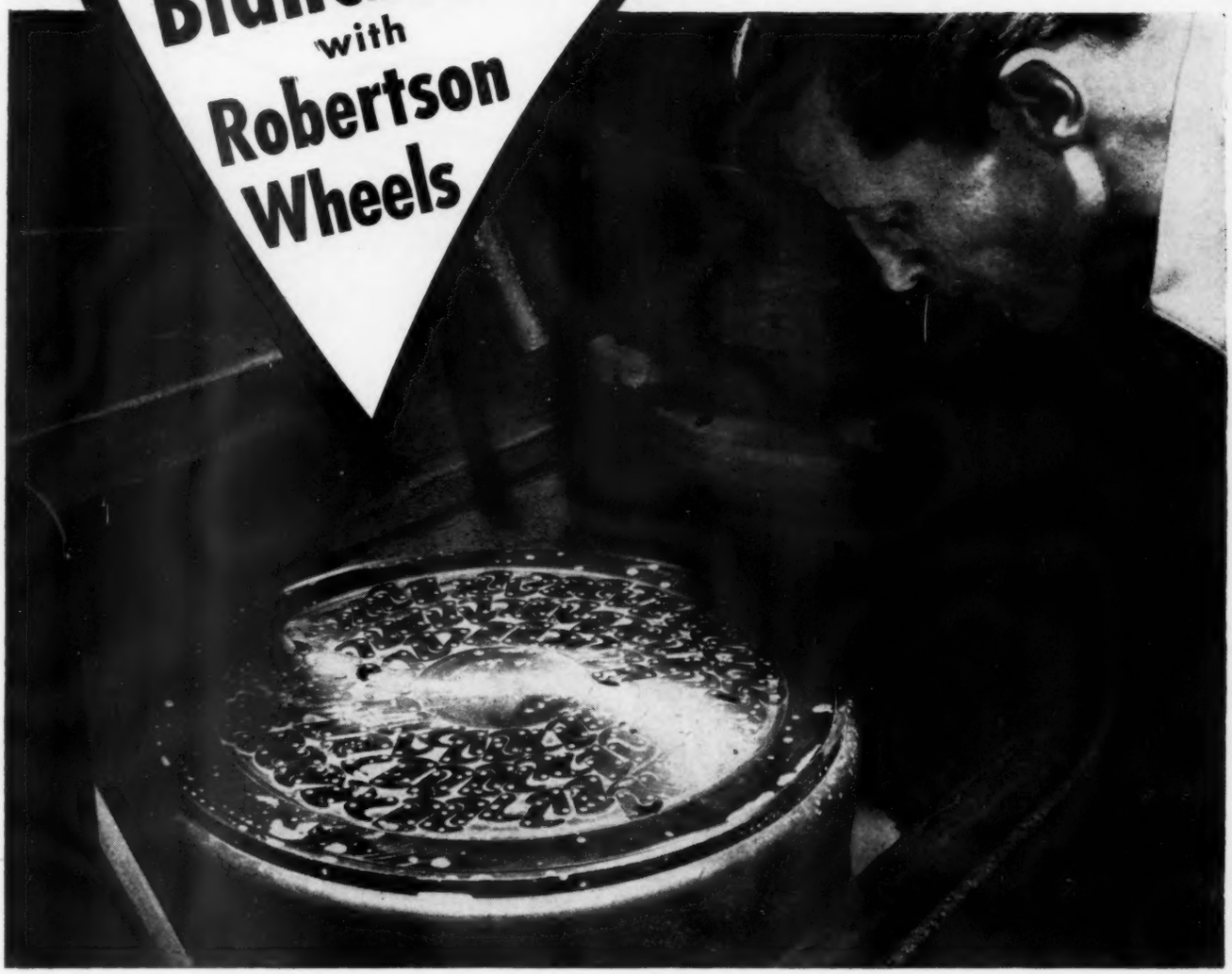
For complete data write to your nearest Airco office for Booklets ADC-628A and ADR-30 or address: Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas. Represented Internationally by Airco Export Corporation.

AIRCO **AIR REDUCTION**

Offices in All Principal Cities

HEADQUARTERS FOR OXYGEN, ACETYLENE AND OTHER GASES . . . CARBIDE . . . GAS WELDING AND CUTTING APPARATUS AND SUPPLIES . . . ARC WELDERS, ELECTRODES AND ACCESSORIES

Get more work out of your Blanchards with Robertson Wheels



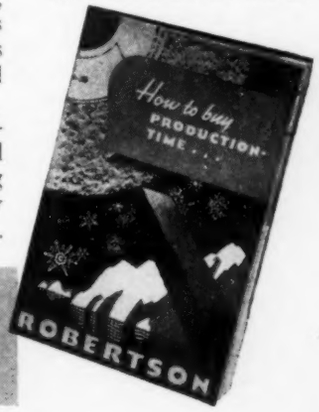
Whether you're working on small pieces or on 30″ x 30″ boiler plate, you'll get better results from your Blanchards if they're equipped with Robertson Cool-Cut Segmental Wheels or Ring Wheels.

These precision-built wheels have proved their ability, time and again, to cut grinding time in half—*or better*. Because of the special Cool-Cut structure, only a few grains are used at a time, providing an unusual degree of chip clearance. The bond holds the cutting grains to the limit of their effectiveness. This increases the life of the wheel and assures cool cutting on the hardest of metals.

One large company, operating on half-inch-thick boiler plate thirty inches square and with a ten-inch hole in the center, was taking 45 minutes to remove .050″ stock from one side. Ampere reading was 67-75. When they equipped the Blanchard with a Robertson Cool-Cut Segmental Wheel, grinding time was cut to 20 minutes (less than half the previous time). Feed was stepped up 25%. Ampere reading dropped to 45-50.

Results such as these, obtained on difficult boiler plate grinding operations, should suggest to you the advisability of using Robertson Cool-Cut Wheels to solve many of your other difficult grinding problems.

Write for a free copy of the booklet, "How to Buy Production-Time," which tells all about Robertson Cool-Cut Wheels.



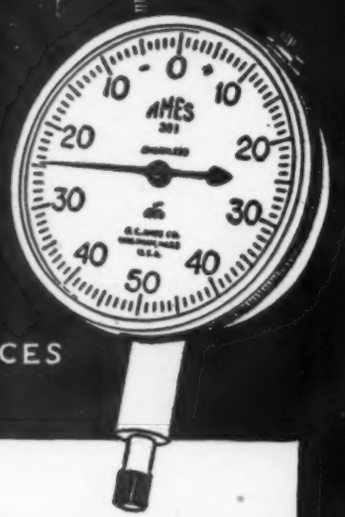
ROBERTSON MANUFACTURING COMPANY
TRENTON 5, NEW JERSEY
Manufacturers of Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

AMES

Hundred Series

Shockless

DIAL INDICATORS



4 SIZES
14 DIAL FACES

Ames Dial Indicators have small and accurately made gear trains for indicating size variations as fine as .0001". These highly sensitive gear trains are protected from damaging shocks by a simple shock-absorber which does not change their action or appearance.

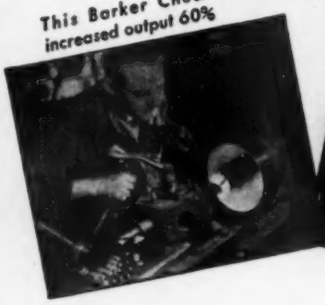
Get acquainted with these popular shockless Indicators by ordering them with any dial numbering desired.

Complete catalog on request.

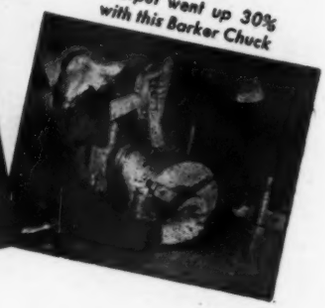
B. C. AMES CO.
WALTHAM MASS. U.S.A.

30 TO 60% MORE PARTS

This Barker Chuck increased output 60%



Output went up 30% with this Barker Chuck



WHEN USING BARKER WRENCHLESS CHUCKS

Barker Two-Jaw Chuck

Barker Three-Jaw Chuck

Barker Two-Jaw Vise

Barker Three-Jaw Vise

Consider the cases of two manufacturers in the central west. One, making bronze plugs, increased production from 75 to 120 parts per hour when he installed a Barker Wrenchless Chuck. The other put a Barker Chuck on an automatic lathe and output jumped up from 18 to 24 pieces per hour. Such results are typical—so typical that many companies enter repeat orders, and numerous shops are using from three to as many as forty Barker Chucks to increase production and cut costs. Saving made by these chucks pay the first cost in an astonishingly short time.

Send piece part prints and outlines of your operations—our engineers will promptly make cost saving recommendations.

Write for Bulletin No. 201

THOMAS HOIST CO.
Chuck Division
20 South Hoyne Avenue, Chicago 12, Illinois

AVAILABLE NATIONALLY THROUGH DISTRIBUTORS!

UNDER VARIOUS TRADE NAMES, Du Pont Trichlorethylene and Perchlorethylene solvents for metal cleaning have served American industry successfully for many years. If you have used vapor degreasing solvents in your plant, no doubt you have used these solvents made by Du Pont.

NOW Du Pont has developed *new and improved* Trichlorethylene and Perchlorethylene — the same fine solvents, but BETTER THAN EVER, thanks to various technical improvements. These are the best Vapor Degreasing solvents we've ever made—the best we know how to make. Use them with complete confidence and assurance for all metal degreasing work. We believe they'll serve you *better!*

NEXT TIME you specify solvents for Vapor Degreasing, specify *new and improved* Du Pont Trichlorethylene and Perchlorethylene—available nationally through distributors as "Triclene" D and "Perclene" and under other trade names. Look to these solvents for superior work, maximum savings! Send today for your copy of our new free book, "Metal Degreasing— Standard Practices."

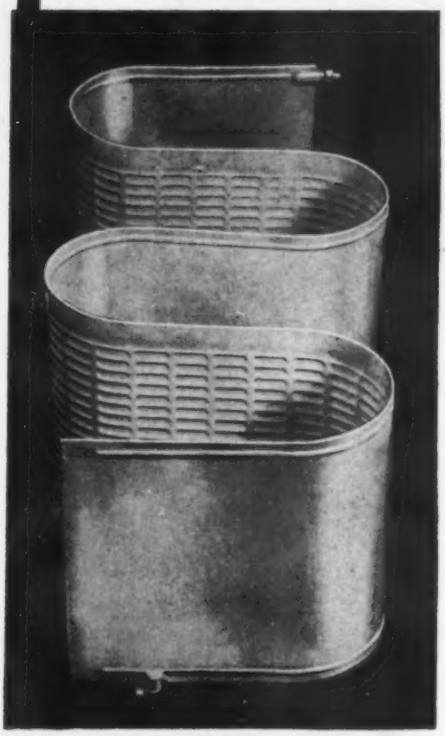
E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department
WILMINGTON 98, DELAWARE

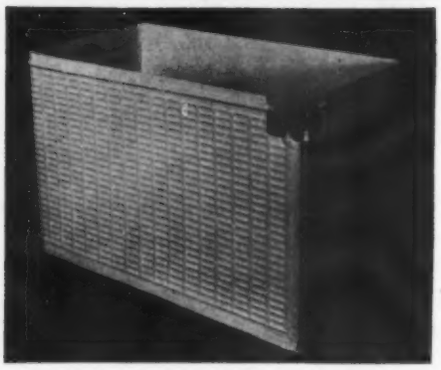
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

DU PONT

DU PONT SOLVENTS

Resistance Welding "by the products like this possible!





The serpentine shaped plate above makes an efficient refrigerating unit for a four-can ice cream cabinet. Square one below it is for a deep-storage unit. Note the bending these welded fabrications must stand and still be gas-tight.

SEVEN Federal 75 KVA press type spot welders and two Federal 150 KVA seam welders deliver close to a million spot welds and some five miles of seam weld weekly to produce thousands of feet of Hubbell-Yoder Refrigeration Plate, at the Cleveland plant of The Yoder Company Fabricating Division.

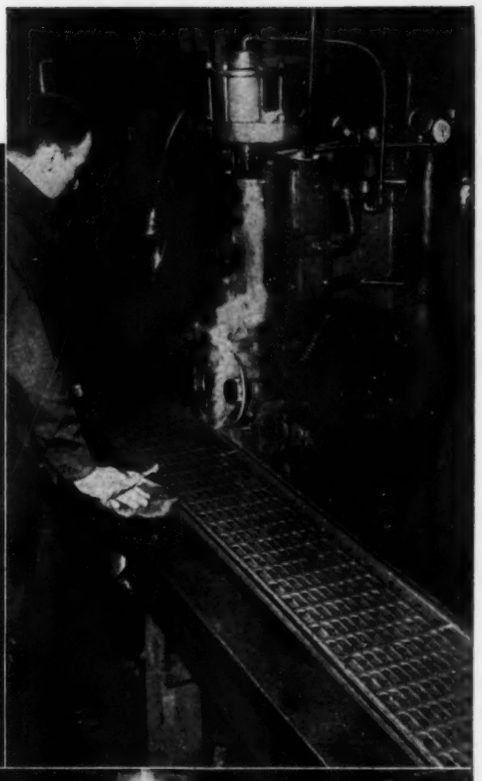
These patented plates make deep storage cabinets, refrigerator cars and trucks, ice cream cabinets and frozen food lockers easier to produce, cheaper and more efficient. They are typical of the many useful products which can be manufactured on a practical production basis only because of the indestructible type of fast automatic fabrication that is natural to resistance welding.

Although similar production can be automatically fed, these plates are hand indexed because of the variety of sizes and shapes involved... from ten to thirty inches wide, two to ten or more feet long. Two sheets of cold rolled steel are used, one perfectly flat, the other press-embossed with interconnected vertical and horizontal channels. The two sheets are welded together with spot welds, using three-quarter inch electrodes, located at alternate ends of the flat rectangular areas between channels. Edges and ends are seam welded. Some of the larger plates have more than 2200 spots and 25 feet of seam weld. These must be high quality welds, air tight, tested to 200 pounds pressure. The plates must

THE Federal MACHINE

SUBSIDIARIES
Sommer and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES
The Warren City Mfg. Co., Warren—HEAVY WELDMENT-HEAVY MACHINERY

Mile" makes



ABOVE . . . A long roller table through the throat of the Federal welder makes indexing the plates an easy matter. This plate takes 1600 spots.

•

RIGHT ABOVE . . . A similar roller table is used with the Federal seam welder. About twenty-two feet of weld around this plate. When Infra-Red-Baked finish is applied to the plates the welds are not discernible.

•

AT RIGHT . . . A few of the many variations in shape of The Hubbell-Yoder plates are shown in this view of the shipping department at The Yoder Fabrication plant.

withstand twisting, right-angle bending, extreme temperature change and in some cases considerable tossing around.

Standard Federal welders and equipment are used in this production. The same installations can be used for an endless variety of ordinary or unusual fabrications, some of which might be yours. It is worth while to remember that resistance welding may well be the answer to some cost cutting problem in your production . . . that Federal engineers are available to help you find out . . . that in resistance welding the name of authority is

Federal

AND WELDER COMPANY

MEMBER RESISTANCE WELDER MANUFACTURERS' ASSOCIATION RWMA

CARBOLOY (TRADEMARK) CEMENTED CARBIDE "STANDARDS"

Speed Production, Cut Costs

ON JOB LOT WORK TOO!

Job lot machining at Oakland Machine Works* jumps from cast iron to steel to aluminum automotive engine parts in diversified quantities and specifications. That means a problem to meet in frequent, fast, tooling change-overs while keeping tool costs low—production on schedule.

By basing tool design, wherever possible, on Standard Tools, quickly ground to fit the job, and by using Standard Blanks to make and repair the necessary range of special tools in their own Tool Department, this job lot shop makes change-overs—meets unforeseen production demands—without costly delays or tool costs.

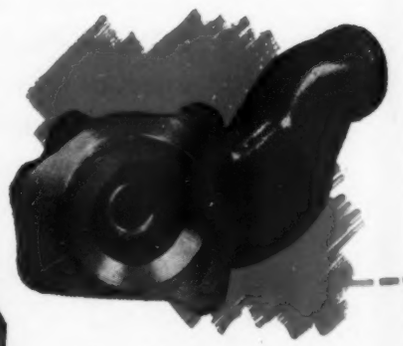
Since most tools are Standards, or "specials" requiring only Standard Blanks modified to fit, they get:

1. Maximum economy—Standard Tools and Blanks are mass produced for lowest cost.

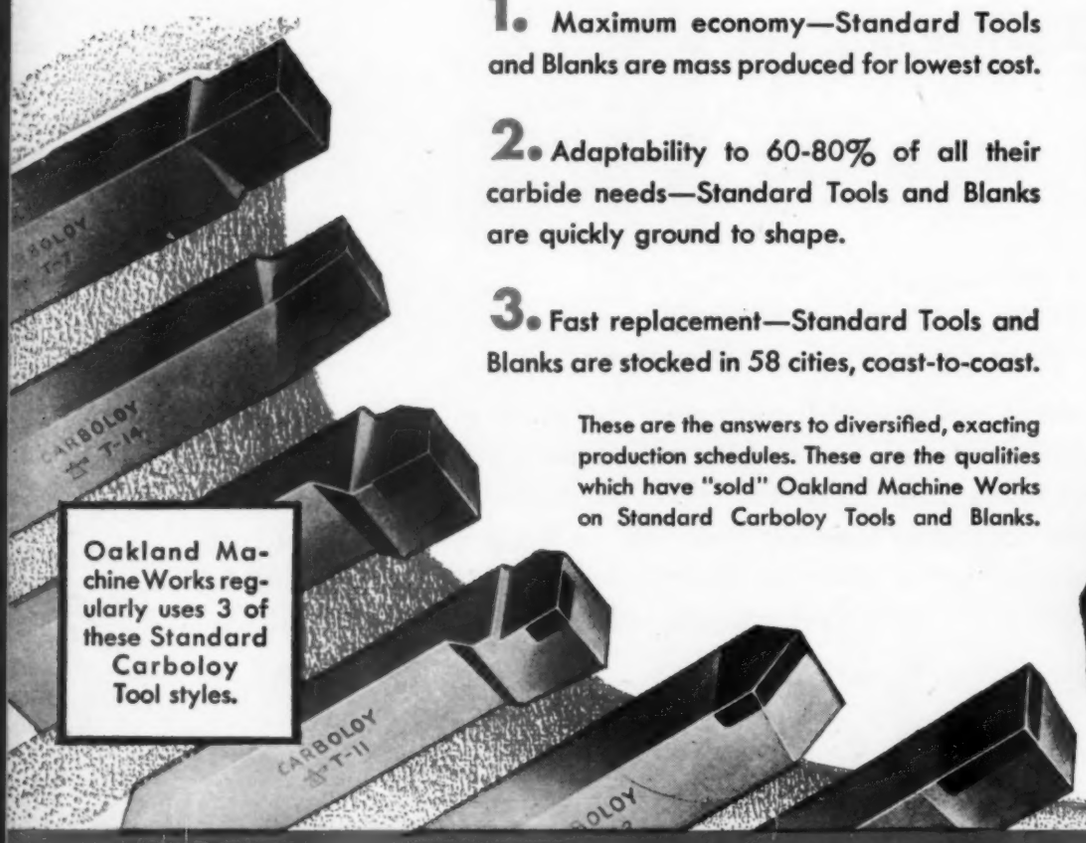
2. Adaptability to 60-80% of all their carbide needs—Standard Tools and Blanks are quickly ground to shape.

3. Fast replacement—Standard Tools and Blanks are stocked in 58 cities, coast-to-coast.

These are the answers to diversified, exacting production schedules. These are the qualities which have "sold" Oakland Machine Works on Standard Carboloy Tools and Blanks.



*Royal Oak, Michigan



Oakland Machine Works regularly uses 3 of these Standard Carboloy Tool styles.

CARBOLOY COMPANY, INC.
11149 E. 8 MILE AVENUE, DETROIT 32, MICHIGAN

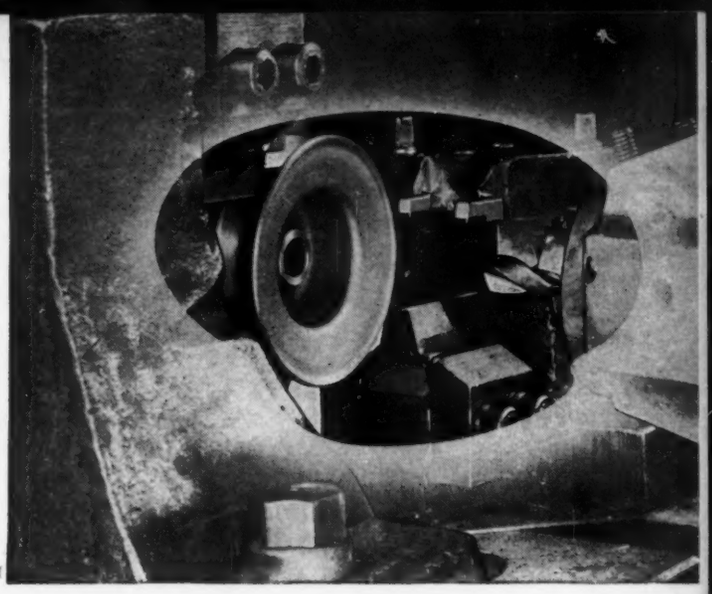
CARBOLOY

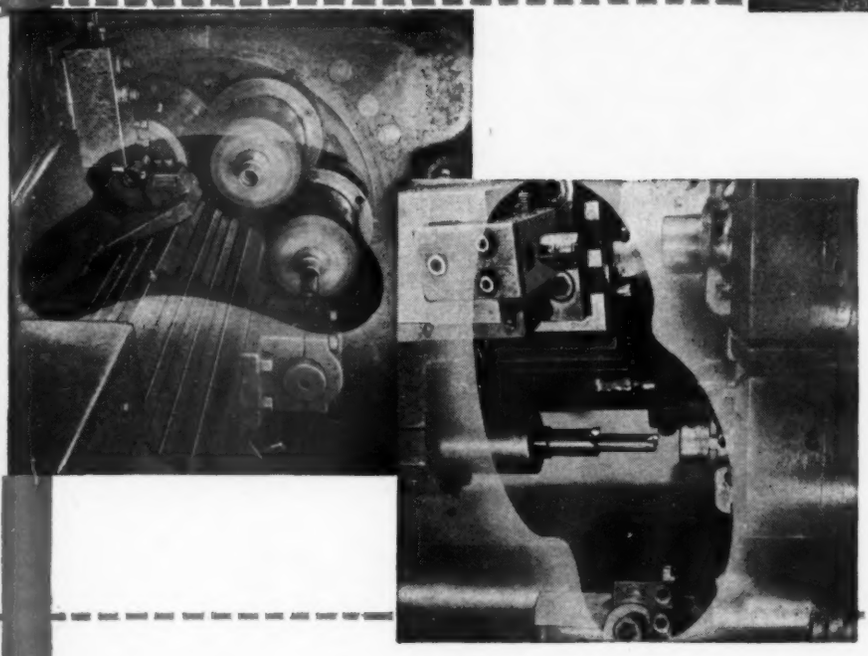
(TRADEMARK) CEMENTED CARBIDE

CHICAGO • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON, CONN.

EXTRA DIVIDENDS FROM "STANDARDS"

On **this** job-lot application—machining cast iron pulleys—"Standards" not only held down **initial** tool costs but also stepped up production; kept machines running 4 times longer per tool grind. For maximum savings, Standard Carboloy Tools were adapted to 8 roughing and finishing operations; while all "specials," except drill, were tipped with "Standard" Carboloy Blanks.



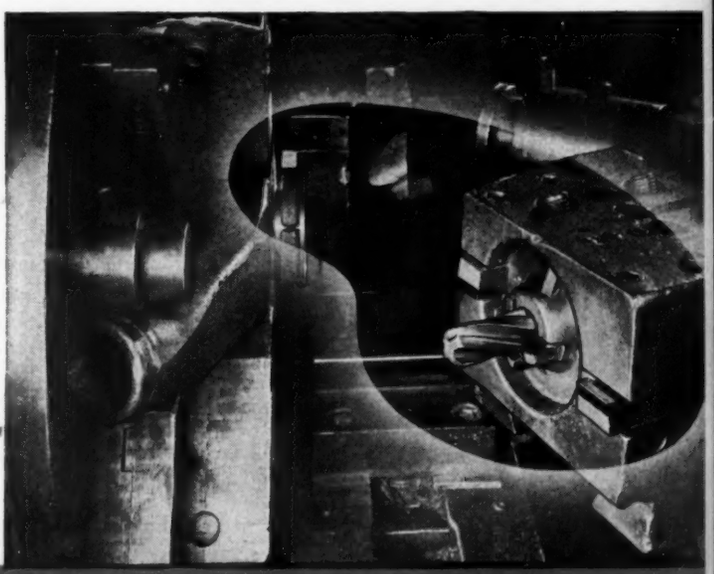


QUICK CHANGES AT MINIMUM CO

On job-lot work, set-ups change frequen "Today" the job is a carbide-tipped 11-t set-up for cast iron water pump housing pa "Tomorrow" it may be an entirely different tool set-up for one-piece aluminum fans c pulleys. By carefully planned use of adapta "Standard" Carboloy Tools, Oakland ke tool cost down despite frequent changes.

MACHINING CAST IRON HOUSINGS AT 340 F.P.M.

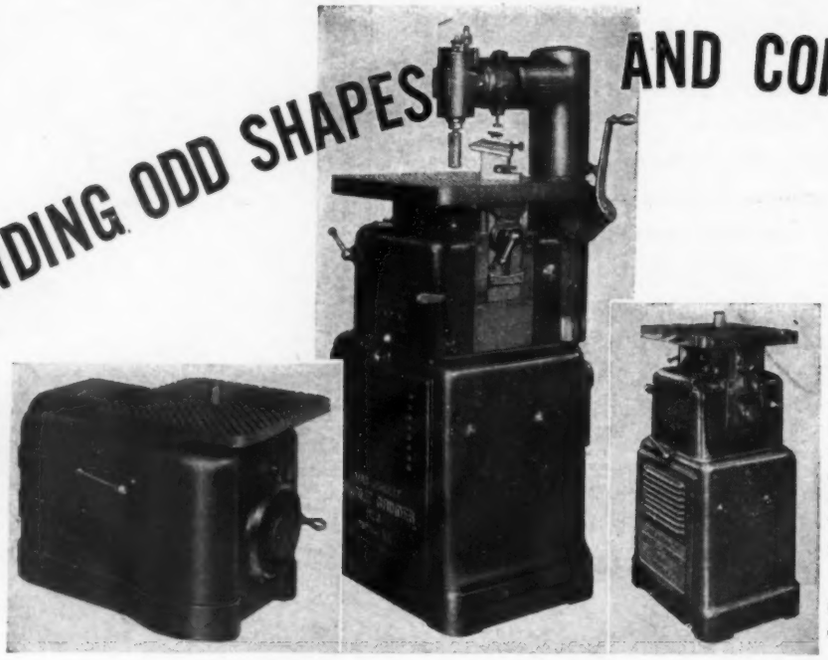
When carbide tools went on this job—machining cast iron water pump housings—speeds jumped to 340 F.P.M.; tool life stepped up 600%. For extra economy, the 7 tools shown were made with "Standard" Carboloy Blanks, available from stock at low cost.



AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS

STOCKED AND SOLD BY LEADING MILL SUPPLY DISTRIBUTORS IN 58 CITIES COAST TO COAST

FOR GRINDING ODD SHAPES AND CONTOURS



No. 1
PROFILE GRINDER

A bench size tool operating at 20,000 R.P.M. with vertical oscillations. For grinding die clearances, sharpening punches and economically finishing cams and templates.

In production grinding too, this Grinder has proved a valuable tool.

Boyar-Schultz Grinders are designed and built for grinding and finishing irregularly curved surfaces and contours so frequently encountered in the tool room and die shop. Dies and punches, templates, cams and special parts are finished with time-saving speed.

No. 2
PROFILE GRINDER

Dual Spindle Model. Larger floor model with two independently powered spindles, operating with vertical oscillations at 10,000 R.P.M.

A rapid stock remover even with small diameter wheels.

Single Spindle Model with lower spindle only. A tool that has demonstrated its value in the tool and die shop.

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Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels.

Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Silicate, Shellac and Resinoid Bonded Wheels.

VITRIFIED WHEEL COMPANY
WESTFIELD **MASS.**

VITRIFIED

If precision is your problem, sleeve bearings will solve it to the fullest extent... In modern aircraft engines and their superchargers—on the spindles of precision machine tools—where precision is paramount—Bunting Cast Bronze sleeve bearings are used... Versatile in design and alloy, Bunting Bearings offer advantages which we would like to discuss with you.

The Bunting Brass & Bronze Co., Toledo 9, Ohio. Branches in Principal Cities.

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BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

42

CARD PIPE TAPS ... *maintain quality under quantity demands*

Card Regular Type High Speed Steel Cut Thread Pipe Taps are ideal tools for high production tapping in cast iron, malleable iron and other materials where chips break up, allowing the tap to properly clear itself.

Card Regular Type High Speed Steel Ground Thread Pipe Taps are recommended for high production tapping in cast iron, malleable iron and other materials where chips break up, allowing the tap to properly clear itself. Used where close accuracy and a high quality of production work is required.

Card Interrupted Thread High Speed Steel Taper Pipe Taps are designed for tapping in soft steel and forgings. They are recommended for use where a particularly fine quality of thread is demanded. These taps have less cutting teeth per thread section; can be operated with less friction and are superior to full thread taps for this class of tapping.

Send for the Card Catalog giving complete details.

SOLD BY LEADING DEALERS

Card Inserted Chaser Taper Pipe Taps are manufactured in carbon and high speed steel types and are furnished with American National Pipe form of thread.

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Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO.

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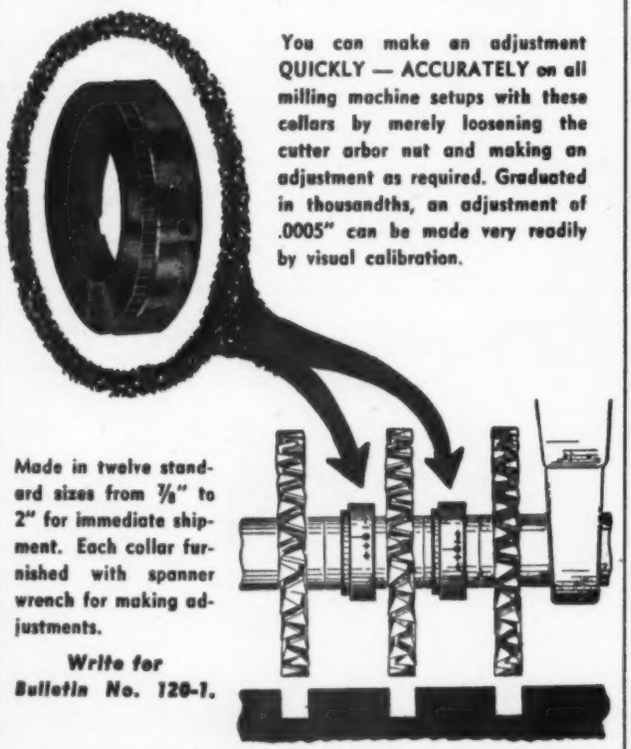
MICROMETER ADJUSTMENT

on side milling cutters and gang milling setups with Dayton Rogers Micrometer Adjustable Spacing Collars



You can make an adjustment QUICKLY — ACCURATELY on all milling machine setups with these collars by merely loosening the cutter arbor nut and making an adjustment as required. Graduated in thousandths, an adjustment of .0005" can be made very readily by visual calibration.

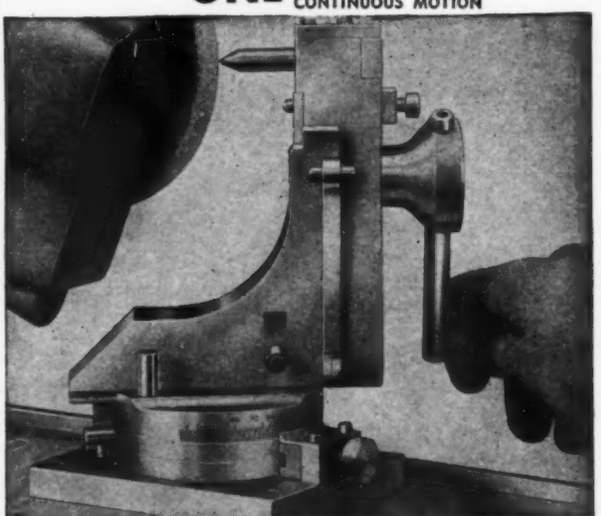
Made in twelve standard sizes from 1/8" to 2" for immediate shipment. Each collar furnished with spanner wrench for making adjustments.

Write for Bulletin No. 128-1.

DAYTON ROGERS MANUFACTURING CO.
MINNEAPOLIS 7 MINNESOTA

USE *Fluid-motion* for modern form-dressing

ONE SETTING HANDLE CONTINUOUS MOTION



J & S Radii & Angle Dressers in the "Fluid-Motion" series are among the finest precision dressing instruments procurable. . . . regardless of cost. There is a standard model to fit most form-dressing requirements.

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Fluid-motion dressing
.0001" accuracy
Automatic centering
7" & 14" wheel capacities
Large range yet compact
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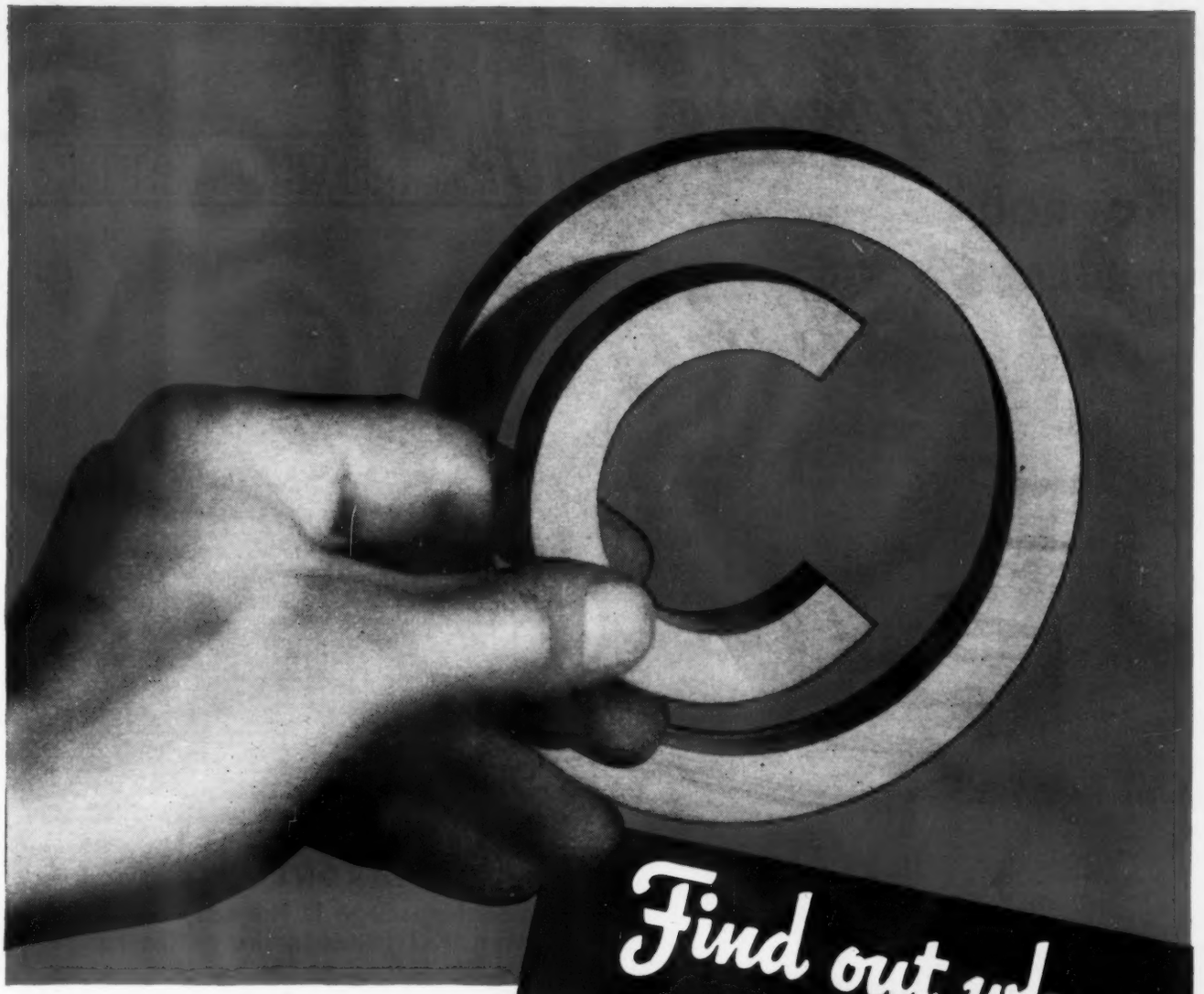

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Circle "C" is the out-and-out choice of many for maintaining peak production and limiting "down-time." Write today for full information, or ask for a convincing demonstration in your own shop.

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The 204 Machine

The Matthews 204 Machine is ideal for marking of part numbers, names, coding, etc. on a range of parts up to 6" in diameter or thickness. The 204 Machine is hand operated and has a capacity of up to 300 uniformly marked parts per hour.

Round parts are marked with solid flat dies or holder with interchangeable steel type. Flat parts are marked by means of solid roller dies or mortised roller dies with interchangeable type. Easy operation enables the operator to work for long periods of time with little fatigue. The 204 Machine can be furnished with pneumatic controls to replace foot pressure.

Consult Jas. H. Matthews & Co., for nearly a century the COMPLETE marking house, for the answer to your every marking requirement. *A product worth marking is worth marking well.*

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INSIDE MICROMETER SETS TU-MI-CO TUBULAR Construction—strong, light, easy to assemble and handle. All tips and connecting surfaces are hardened and lapped for long, trouble-free service. Sets complete with mandrels, wrenches, instructions—in strong wood cases.

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The aim of all tapping is high production at low cost. With a relatively inexpensive Ettco-Emrick Tapping Attachment on the spindle of your drill press, you can hit this bull's-eye every time. Not only are your initial costs low, but you save on labor and production costs—because even inexperienced operators can tap fast and accurately with Ettco-Emrick Tapping Attachments . . . Tapping skill is built into these attachments by exclusive Ettco-Emrick design and construction features. They give full protection against work spoilage and broken taps.

BULLETIN NO. 2 gives full details.
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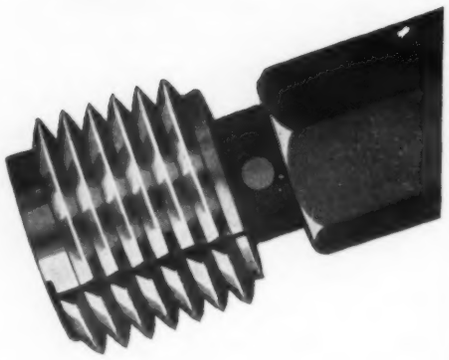

A GOLF CHAMP HAS IT—

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You can't see "THAT UNSEEN EXTRA QUALITY" but it is there;—in each gage, driving "the cost per hole gaged" to a new low.

More and more, men who know are turning to Republic Gage Company to supply their gaging needs.

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TOOL HOLDER

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Excess heat is destructive to diamonds . . . makes them brittle which promotes costly cracking and chipping. Internal ducts and fins in the JKS Sta-kool holder allow a constant flow of coolant (or air—in dry grinding) behind the diamond. This dissipates the heat generated in the nib and *prevents* the rise of temperature above the danger point. As a result . . . tool life is prolonged and diamond dressing costs are reduced by ⅓ to ½.

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• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

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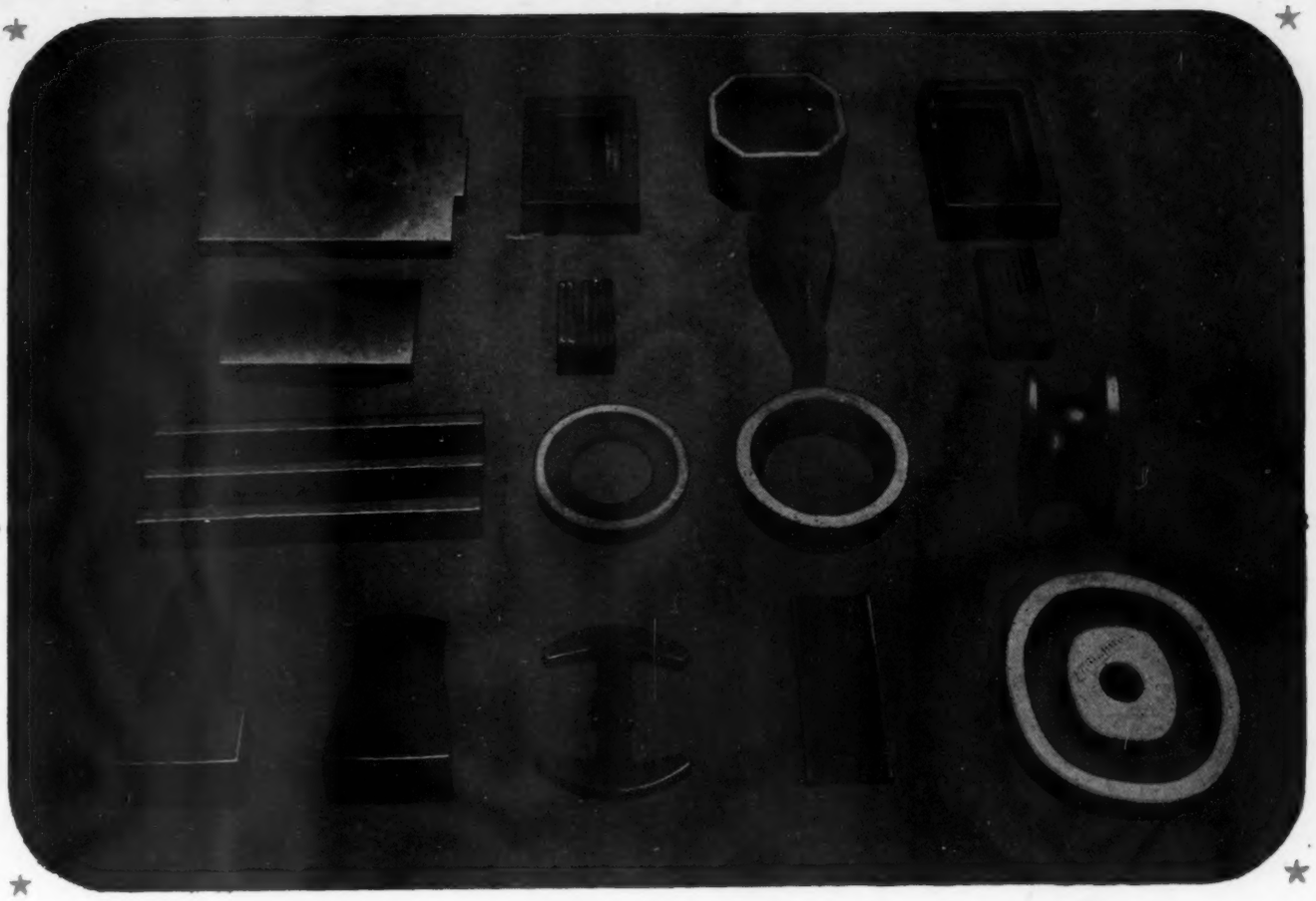

START WITH YOUR JOB *Half Finished*

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It contains details of FCC Tool Steels *Cast-To-Shape* and of other important Forging and Casting Division specialties that may offer you money-saving production ideas. Get your copy—write for it today.

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WHEN it's dies you're making—small or large—or various other forming tools or gages or certain fast-wearing parts of machines, FCC Tool Steel *Cast-To-Shape* can really save you money.

Very intricate shapes can now be cast in one piece within an eighth-inch of finished size. This means that you pay for less steel to begin with, and reduce machining time substantially.

Air Hardening, Oil Hardening and special Hot Work Tool Steels of various grades—each a thoroughly dependable performer in its class—are promptly available in this modern, economical form.

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THE *New* CLEVELAND INDEX HEAD

Regrind YOUR TOOLS IN EXACT CONCENTRICITY ON ANY SURFACE GRINDER

DESIGNED TO HOLD ALL TOOLS WITH STRAIGHT OR TAPER SHANKS From 1/16" to and incl. 1-1/2" Diam.

No longer need you discard your taps, reamers, end mills, etc., when they become worn or damaged.

360 degree graduations in three planes enable you to grind any desired angle or cutting edge on your tools with factory precision . . . in your own shop . . . on any surface grinder.

Write for catalog and complete information. See for yourself how you can reduce your tool maintenance costs with the Cleveland Index Head.

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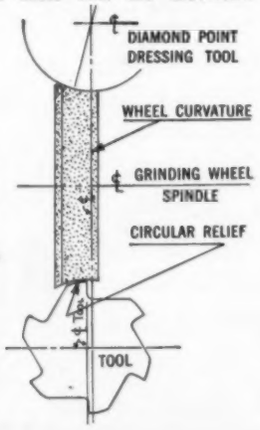
A new method for regrinding tools. *Leaves No. Land.* Ideal for spiral reamers, bent shank taps, end mills, etc. Complete data and information on request.



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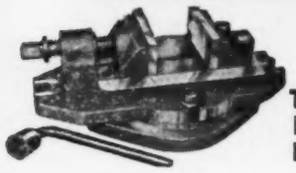

THE *RIGHT* VISE FOR EVERY JOB IN EVERY SHOP

Every milling machine, drill press and surface grinder in every tool room or machine shop can be made to produce more work and more accurate work by using Producto Machine Vises. Hardened and ground parts that are fitted to close tolerances hold work absolutely rigid . . . saving time and money on costly rejects.

A wide variety of types and sizes is available for precision tool room work or production . . . Heavy Duty, Self-Centering, Screw Acting, Cam Lock, Quick-Lok and General Purpose Vises.

Also makers of Die Sets, Die Makers' Accessories, Hand Tapping machines and Utility Presses. Distributors of Dickerman Automatic Press Feeds.

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BY FURNACE
with Silver and Copper
BY . . . INDUCTION
with Silver Solder
BY TORCH
with Silver Solder
AS TANGIBLE ASSURANCE YOU
1. OBTAIN IMPROVEMENTS IN YOUR PRODUCT QUALITY
2. INCREASED SPEED OF YOUR PRODUCTION
3. REDUCED COST OF YOUR PRODUCTION
BRIGHT ANNEALING
INDUCTION HARDENING
A. H. HYNDMAN COMPANY, INC.
CHICAGO 28
ILLINOIS

YOU'LL see many examples in this bulletin that show the ability of this organization for fabricating and joining metal assemblies and metal parts of all kinds by Furnace, Induction, and Torch.

Whether you are designing a new product, modernizing an old one, or seeking a more satisfactory and faster method of producing simple or complicated assemblies for a standard product, we can save you time and money, through our highly specialized brazing service. Our quality results insure definite improvements in your product quality.

Our service includes BRIGHT ANNEALING and INDUCTION HARDENING.

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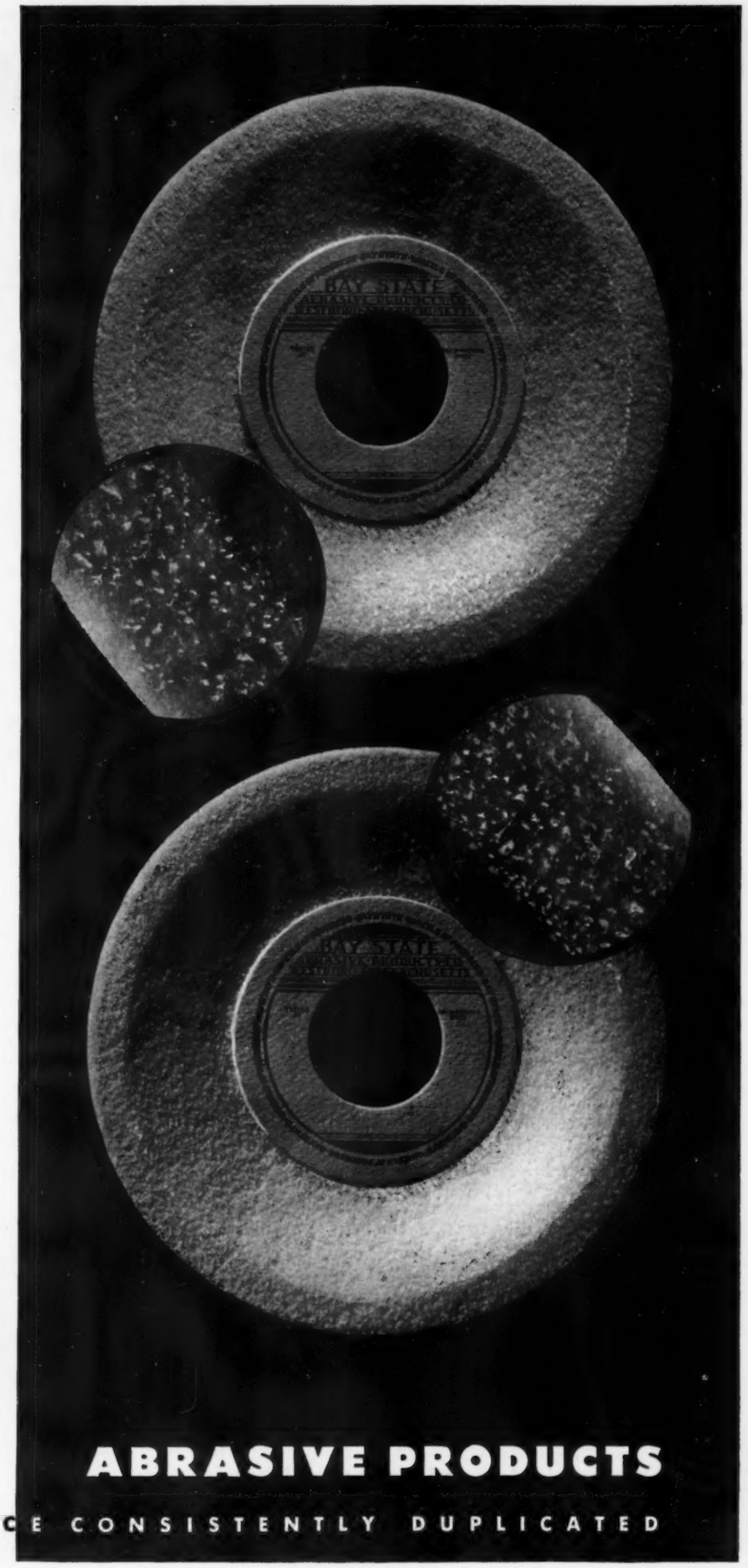

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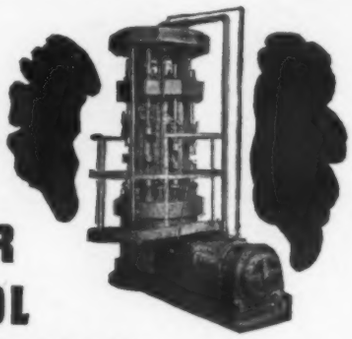

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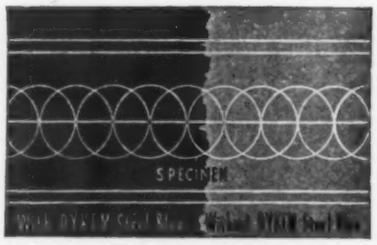

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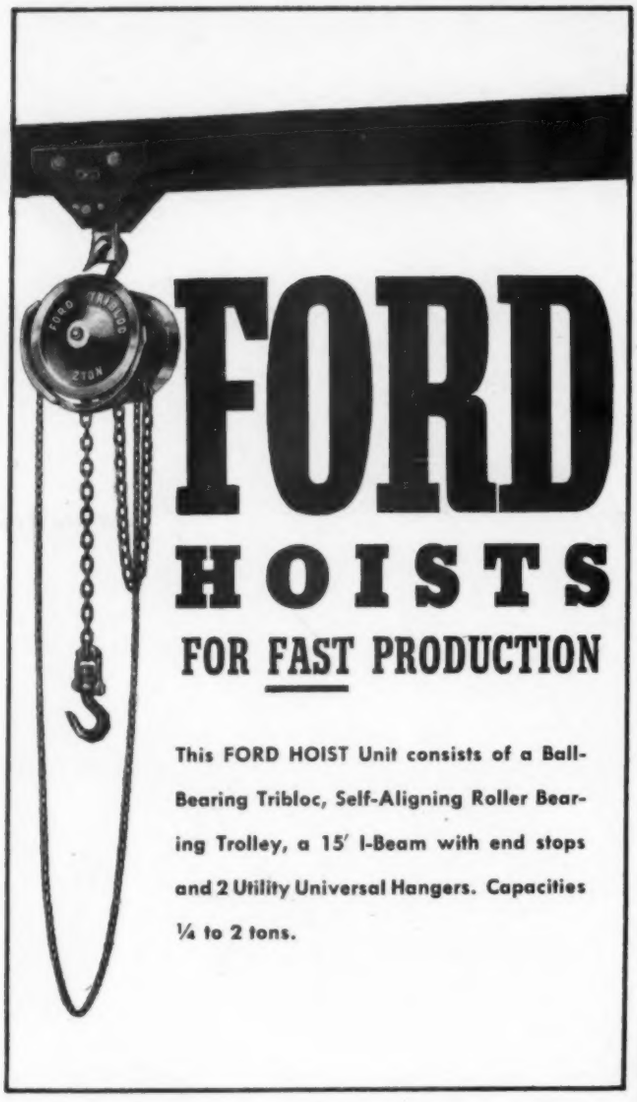

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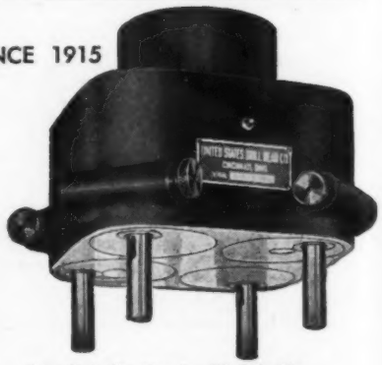

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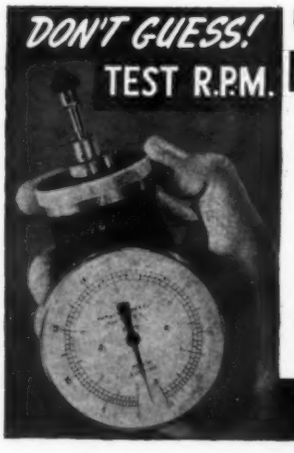

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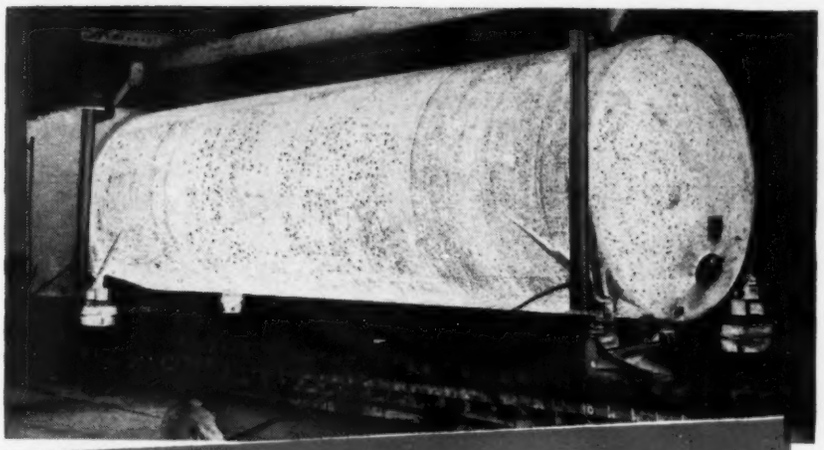
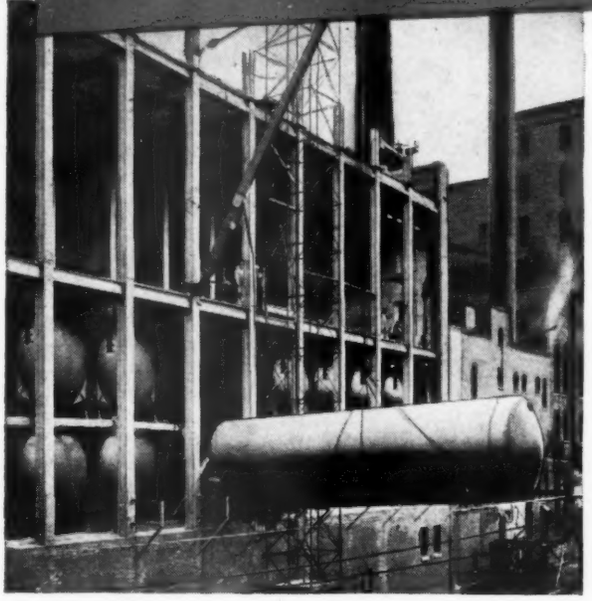


Out of Welding Research... BETTER BEER



1946 Since the first SMITHway Glass-Lined Storage Tank was built in 1933, hundreds of brewers throughout the world have equipped their lagering cellars with SMITHway glass-lined tanks . . . a combined storage capacity of 39,486,188 gallons.

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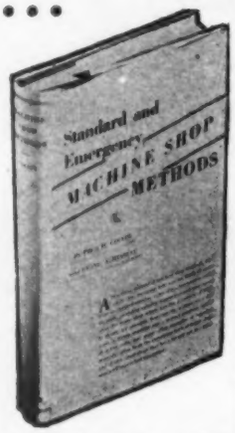

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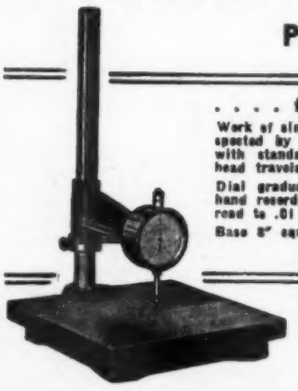

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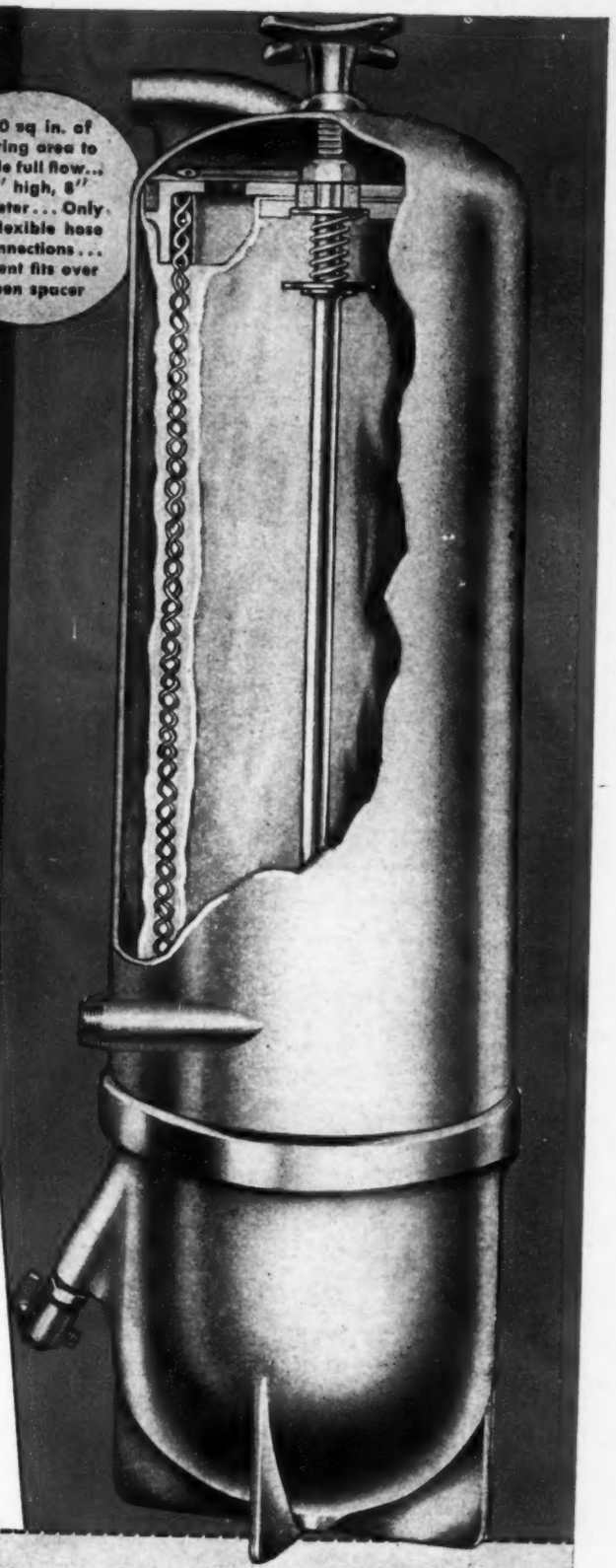

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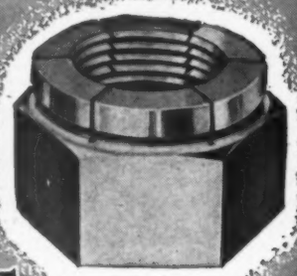

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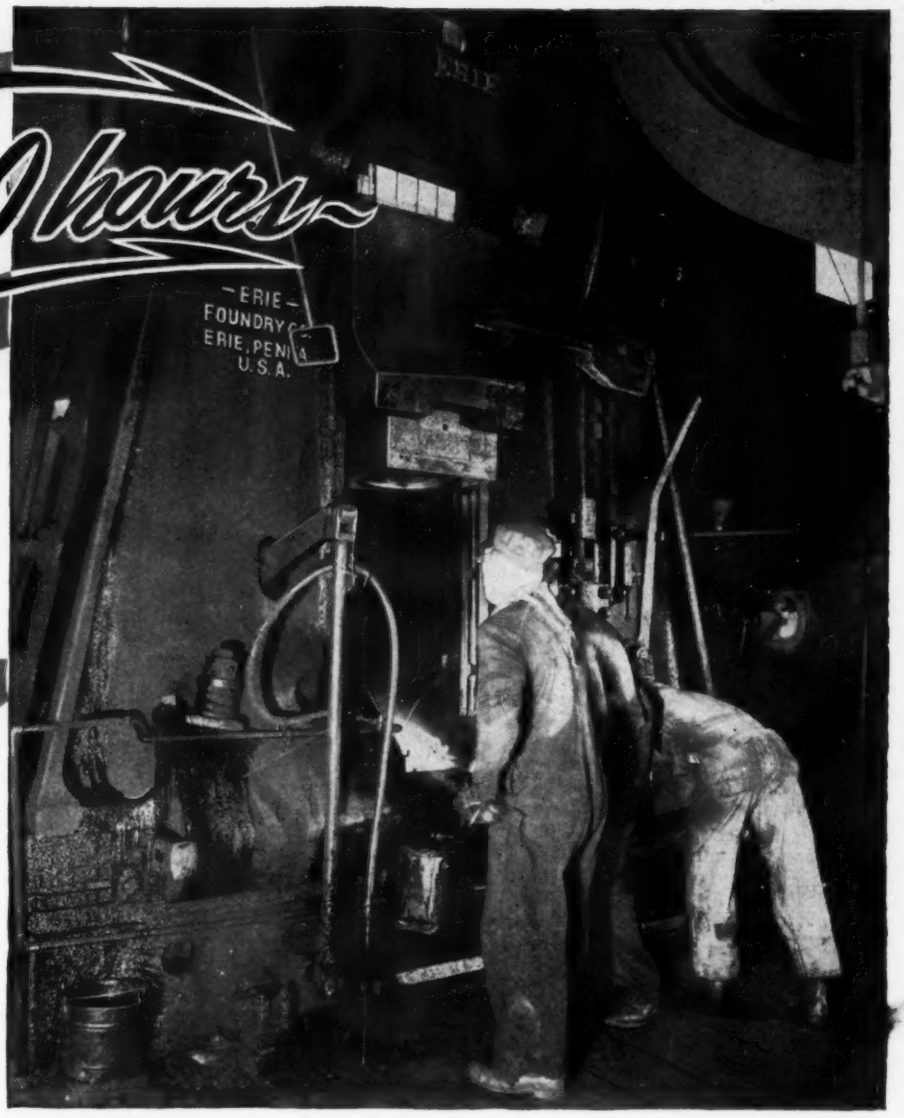

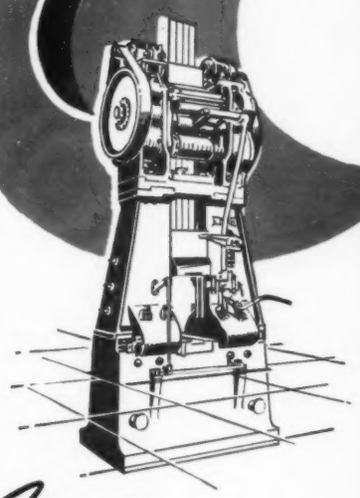

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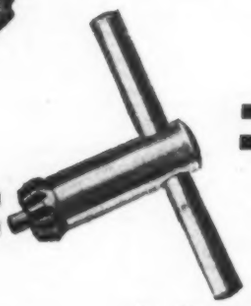

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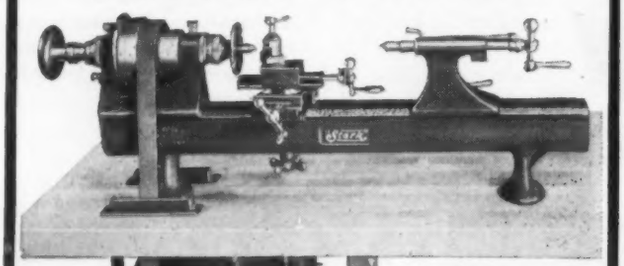

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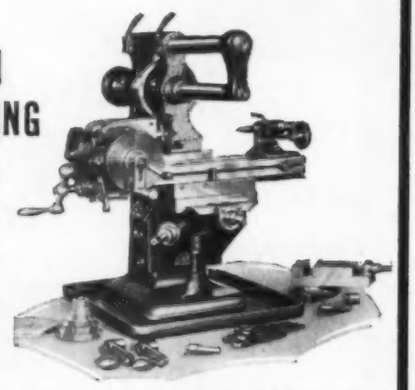

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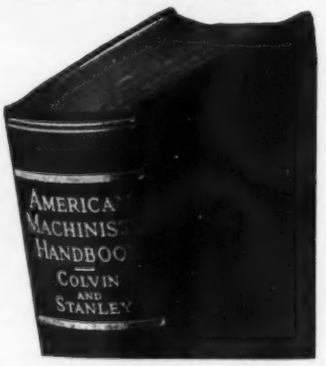

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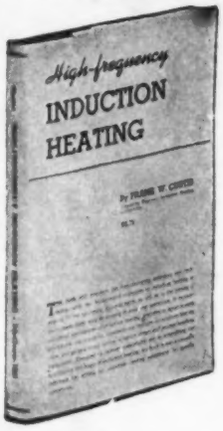

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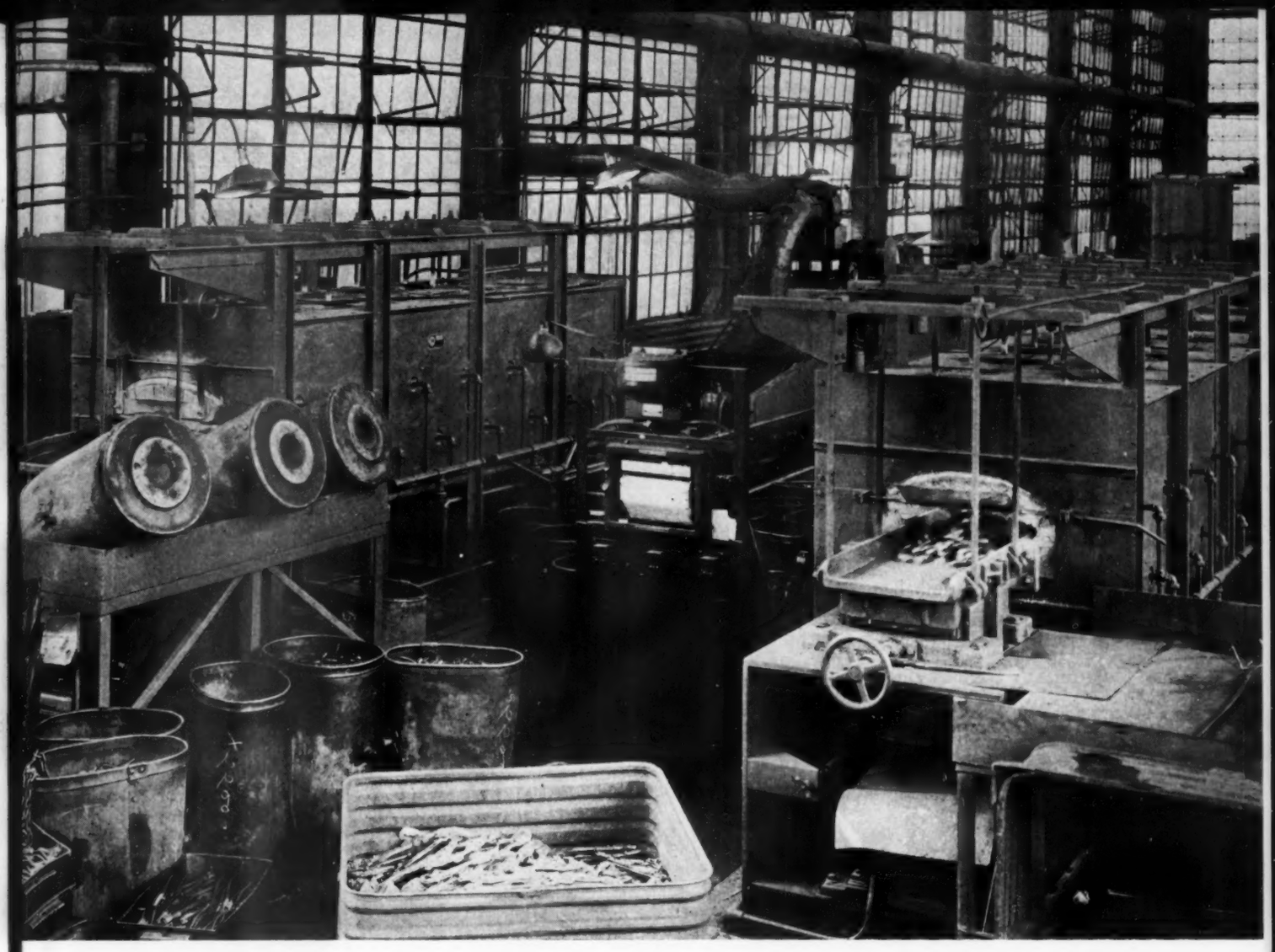

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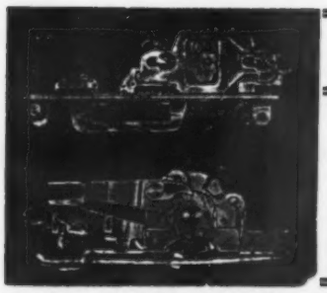

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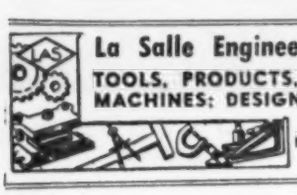

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Additional Contract Work Advertising on Page 311

Contract Work Available see (CW.685) page 312

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(Additional Positions Vacant ad on page 312)

DIE SINKER: Experienced on die castind die work for day shift in a modern shop. Good wages with manufacturer in Essex County, N. J. P-675, American Machinist, 330 W. 42nd St., New York 18, N. Y.

OLD ESTABLISHED and prominent machine tool builder located in Connecticut has position for qualified man to take charge of advertising and sales promotion. Must have thorough knowledge of machine tools. P-676, American Machinist, 330 W. 42nd St., New York 18, N. Y.

JOBBING SHOP superintendent. Location south central part of New York State. One who has had thorough experience in all class of work such as tools, dies and fixtures, and capable enough to handle a hundred men. To such a person, we can offer an unusual opportunity both in position and salary. Full details regarding previous experience must be given in order to receive consideration. P-691, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITY OFFERED

SALES ENGINEER: experienced selling flexible shaft and flexible shaft equipment to manufacturers, hardware and automotive trades. Excellent opportunity to grow with line. Well established firm. Replies confidential. SW-677, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of thirty-six years' recognized standing and reputation carries on preliminary negotiations for supervisory technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

(Continued on page 312)

WANTED

MECHANICAL ENGINEER

Must have intensive experience in the designing and production of screw pumps. Write names and addresse of all former employer; age; salary desired.

P-611, American Machinist
330 W. 42nd St., New York 18, N. Y.

CONTRACT WORK

(Continued from page 310)

METAL MANUFACTURING CORPORATION

ALUMINUM AND STEEL FABRICATORS

Serving Light and Heavy Manufacturing Firms from Simple Fabrication to Complete Assemblies.

Engineering Service. Inquiries Answered Promptly

P.O. BOX 1495 **LOUISVILLE, KENTUCKY**

SEARCHLIGHT SECTION

ENGINEER

Experienced man in mechanical press field for sales and engineering by old established press builder. Technical education desirable. Salary commensurate with experience.

P-689, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

(Continued from page 311)

POSITIONS WANTED

FACTORY MANAGER: Master Mechanic or Chief Industrial Engineer; graduate cooperative engineering and industrial management course. Age 39, over 25 years experience, includes operating supervision, material and production control, purchasing, time study and standard control of labor costs, methods, work simplification and cost reduction programs, maintenance cost, cost control, and tool usage control, production tooling and machine maintenance, tool making, tool inspection, tool design, tool trouble, process engineering, inspection and quality control, expediting, coordination of Vendor's quality and standards, sales and service. Successful labor relations in large and small plants. Products include diesel, marine, stationary and outboard engines, and Detroit's auto, truck and aircraft industry. Location open. PW-678, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

GEAR ENGINEER: fifteen years experience in design and production of precision instrument gears. Available about June first. PW-680, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PRODUCT DESIGN engineer with nineteen years of successful product designing plus tool designing and machine shop supervision. Experience on precision products, pneumatics, electrical and mechanical movements, gears, die castings, stampings, forgings, etc. Knows steels, heat treatments and machine tools. College graduate, age 42, married. Capable of taking complete charge of engineering. PW-692, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER: University graduate, licensed in Michigan, 36 years old, married, three children. Twelve years industrial experience as design, development and production executive. Excellent background as supervisor and work organizer in engineering field. Has always received rapid promotion. Will move if necessary. PW-693, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

SELLING OPPORTUNITY WANTED

MANUFACTURERS: ACCOUNTS solicited by sales engineers representing manufacturers in Indiana, Ohio, Michigan. Designing staff available. Include literature with proposal. Barton and Burns, P. O. Box 373, Fort Wayne, Ind.

MANUFACTURERS: MACHINE tools and industrial equipment; Products must increase operation efficiency and reduce manufacturing costs. Manufacturers representative with finest contacts with machine shops and manufacturers of metal products in northern Illinois excluding Chicago seeking three additional quality product lines. Background—Graduate Apprentice Machinist, Purchasing, Sales, Industry Advisory capacity war-time government agency. RA-651. American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

ESTABLISHED IMPORT & export firm located in Shanghai, China desires additional connection with leading manufacturer. References furnished. Add: Ray Snyder c/o W. E. Dean & Co., 415 Lexington Ave., New York City N. Y.

PATENT ATTORNEY

PATENTS COPYRIGHT, Booklet "General Information concerning inventions and patents" and "Fee Schedule" sent without obligation. Established 1915, Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W. Washington 5, D.C.

WANTED

ANYTHING within reason that is wanted in the field served by American Machinist can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

MACHINERY MEN

A splendid opportunity for two young men with machine shop, tool designing or engineering experience to learn machine tool selling. Also a young machinist with technical education to become a machine tool service man and demonstrator in Eastern territory. For consideration write full details about yourself in own handwriting to:

P.O. Box 549, Orange, N. J.

WANTED
SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-609, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
SALES ENGINEERS
New York Metropolitan Area

To represent highly specialized distributor on

H.S. and Carbide Cutting Tools
Grinding Wheels, Machine Tool
Attachments and Accessories,
Light Machine Tools

Submit written application, which will be held confidential, giving age, education and experience. Must have previous sales or shop experience in this general field. Salary and commission.

SW-683, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

MANUFACTURERS REPRESENTATIVE
PHILADELPHIA & VICINITY

Active in this area for past 25 years possessing sales and executive ability invites correspondence with manufacturers of products salable to Machinery and Machine Tool Users. Organization should be high grade and progressive in product and management.

RA-682 American Machinist
330 West 42nd St. New York, N. Y.

MANUFACTURERS REPRESENTATIVE
CLEVELAND AND VICINITY

Resident of this area for past 15 years, with 25 years Tool Engineering experience, invites correspondence with manufacturers of tools and machines salable to the machine tool industry IN NORTHERN OHIO.

RA-654, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

WANTED

A LINE OF
ADJUSTABLE REAMER
AND BORING BARS

by a manufacturers representative selling outstanding gaging equipment to leading plants in Illinois, Iowa, Indiana, and Western Michigan.

References furnished upon request.

BOX RA-690
AMERICAN MACHINIST
520 N. MICHIGAN AVENUE
CHICAGO 11, ILLINOIS

MACHINE TOOLS

• Rebuilt • Realigned
• Hand Scraped

Work done on your premises by expert.

Accuracy guaranteed, prices reasonable.

MAX OETTINGER
30 Seaman Ave., New York 34, N. Y.

WANTED

COMPLETELY MACHINED
GREY IRON CASTINGS
TO OUR BLUEPRINTS
We will furnish patterns.

Also would like to sub-out special machine work.

CW-685, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

Don't forget
the BOX NUMBER

. . . when answering the classified advertisements in this magazine. It's our only means of identifying the advertisement you are answering.

Auction Advertising page 324, Equipment Wanted page 323

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

AUTOMATICS

1—#00G Brown and Sharpe Standard Speed
1—#0G Brown and Sharpe Standard Speed
2—#00 Brown & Sharpe Standard Speed
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 1⅝" 4-spindle Automatics, complete
1—#55 National Acme 1⅝" 4-spindle Automatics, complete
1—#2G Brown & Sharpe Automatic. Needs rebuilding. Cheap.
2—3¾" Cleveland Model A.

LATHES

14" x 6' Hendey Toolroom, Q.C.G.
14" x 12' Hendey Toolmakers, motor drive.
16" x 6' Rockford Toolroom Lathe.
16" x 6' American Motor Driven Lathe.
27" x 18' Lodge & Shipley Geared Head.
26" x 12' Putnam Quick Change Gear.
16" x 30' Hendey Yoke Head Lathe
48" x 30' Simmons Geared Head, 1941.

TURRET LATHES

4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Hand Screw Machines, arr. Motor Drive.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal
#6A Potter & Johnson Automatic Chuckers.
#3R Gisholt Universal like new.
#4 Warner & Swasey with Cross Sliding Turret, Motor Drive.
#4 Foster Turret Lathe.
3—Morey #2G Geared Head Turret Lathe, motor drive (late model)
2—Simmons #2 (microspeed) Turret Screw Machine (late model)

PLANERS

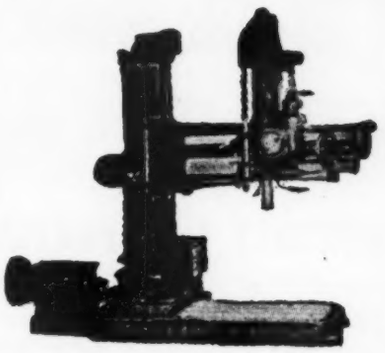
30" x 30" x 10' Cinn. Heavy Pattern, 2 Hds.
20" x 20" x 24" N.-B.-P., Planer Shaper.
26" x 26" x 8' Gray Planer, 2 heads

SHEARS & METAL WORKING

Lennox Splitting Shear ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Gould & Eberhardt Slitting Shear, 10 ga.
Bertsch 3"x36" Geared Slip Roll Former.
Niagara 48" Roller Leveller, 6 Rolls.

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
No. 1 Bickett Vertical Bench Miller
#1-#1½- #2 Brown & Sharpe Plain Miller.



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#2½ LeBlond Universal.
#3B Hendey Universal Miller, motor drive.
1—Cincinnati #4 Vertical Milling Machine, H.P., S.P.D. Geared feeds and speeds.
1—#1 Knight Vertical Miller.

RADIAL DRILLS

3' 9" column Cincinnati-Bickford.
3' 9" col. American, S.P.D.
3' Dreses, 10" col. QCG., M.D.
5' Arm 13" Column Cincinnati-Bickford.
5' Arm, 14" Column Fosdick, motor drive.
5' Arm 14" Col. Fosdick.
6' Arm, 15" Column Cincinnati-Bickford

GRINDERS

1—#3 LeBlond Tool and Cutter, Motor Drive
1—#11 B & S Plain Cylindrical, SPD.
#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
10" x 18" Norton Cylindrical.

Blanchard Grinder #16, 30" dia. magnetic Chuck, 25 HP 3-60-440 V Motor.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M.T.

POWER PRESS HEADQUARTERS

#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed 24" x 36", 4-post.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Cam Press. Plain flywheel drive, double roll feed.

SHAPERS & GEAR CUTTERS

20" Gould and Eberhardt Single Pulley Drive
#1 Adams Gear Hobbers, Belt driven (3).
21" Smith & Mills B.G. Helical Gears.
Niagara 36" Power Holder, 20 Gage.

MISCELLANEOUS

Thomson Cutter and Creaser, 12½ x 18½.
Heat Treating Furnaces for the tool room.
Hydraulic Pumps—Hele Shaw, Racine, Oil Gear, Motor Driven.
Blake and Knowles 12 x 2 x 12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½. New this year.
#5A High Speed Riveting Hammer.
Baker #0 Keyseater 1" x 9" Cap.
1—Paragon Continuous Blue Printing Machine, complete with dryer, motor driven

Waterbury-Farrell Cold Header, double stroke, open die, ½" x 6".
Manville #3—⅜" Thread Roller
#30 Waterbury-Farrell Thread Roller. New 1943.
#20 Waterbury-Farrell Thread Roller, Hand Feed.

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Telephone
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MACHINERY COMPANY
Machinery Merchants

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MOREY . . . . .

1500 MODERN MACHINE TOOLS for IMMEDIATE DELIVERY

CONSULT THIS PARTIAL LIST

● MILLING MACHINES—Plain

BROWN & SHARPE #2 light type—latest
BROWN & SHARPE No. 2B, No. 4B standard type—Timken Bearing—latest type
CINCINNATI #2 Timken Bearing—Dial Type—latest type
KEARNEY & TRECKER No. 2H, No. 3H Timken Bearing—latest type
KEARNEY & TRECKER No. 2K, No. 3K, #2A, Timken Bearing—latest type
KEMPSMITH No. 4 Maximiller—Timken Bearing—latest type

● MILLING MACHINES—Universal

BROWN & SHARPE No. 2A Timken Bearing—latest type
VAN NORMAN No. 26 Timken Bearing—latest type

● MILLING MACHINES—Vertical

BROWN & SHARPE #5—motor drive
CINCINNATI No. 2, No. 3 Timken bearing—Dial Type
GORTON No. 8½D Vert. High Speed—latest type
KEARNEY & TRECKER No. 2H, No. 3K—Timken Bearing—latest type

● MILLING MACHINES—Manufacturing

BROWN & SHARPE No. 10, 12 Auto. Timken
CINCINNATI 45x48 Hydro, Timken Bearing—latest type
CINCINNATI 4-36 Hydro. Timken Bearing—latest type
CINCINNATI No. 0-8 Vert. & Pl. Auto. Timken Bearing—Latest type
CINCINNATI No. 1-12, No. 1-18 Plain Automatic Timken Bearing—latest type, Rise & Fall
INGERSOLL 24x24x8' Planer type—1 head
INGERSOLL 36x48x18' Planer type—4 heads
INGERSOLL 42x36x16' Planer type—4 heads
KEARNEY & TRECKER No. 1218 Auto. Timken Bearing—Latest Type
KENT OWENS No. 2 RV Hand Miller—Timken Bearing—latest type
MOREY No. 12M—2 spindles Profiler and Milling Machine
OHIO Auto. 36" table—Timken Bearing—latest type

● THREAD MILLING MACHINES

PRATT & WHITNEY 4½x12, 6x20 Model B, Model C latest type
PRATT & WHITNEY 6x120, 6x132—motor drive
MOREY SHIELDS 12x30, 12x60, 12x120, 12x192—latest type

● SHAPERS

DILL 18" Vert. Shaper—slotter—M.D.
JONES 6" Vertical—latest type
MOREY 10", 14" Vertical—latest type
MORTON 30" Draw Cut
PRATT & WHITNEY 6" Vertical Motor drive
PRATT & WHITNEY 10" Vertical M.D.
RHODES 7" Comb. horiz & vert.

● GRINDERS—Surface

ARTER 8" Rotary Surface
ARTER Automatic Piston Ring
BLANCHARD #16A-26" Chuck motor drive
BLANCHARD #16—26" Chuck—motor drive
BLANCHARD #18—30" Chuck motor drive—latest type
GALLMEYER & LIVINGSTON No. 25 6"x18"—Hydraulic—latest type
GALLMEYER & LIVINGSTON No. 35 8"x24"—Hydraulic—latest type
MATTISON 12 x 14 x 48'—Hyd.—latest type
MATTISON 16x24x96—Hyd.—latest type
NORTON 6"x18"—Hydraulic—latest type
NORTON 10x60—Hydraulic—latest type
PRATT & WHITNEY 14x60 Hydraulic—latest type

● GRINDERS—Cylindrical plain and universal

BROWN & SHARPE No. 1, No. 2, No. 3, No. 4 Univ.; latest type
BROWN & SHARPE No. 5 Pl, 3x18—latest type
BROWN & SHARPE No. 23 Plain, 10x48—latest type
CINCINNATI 16 x 48 Pl.—latest type
LANDIS 12 x 64 Univ.—latest type
LANDIS 6 x 20 Pl.—latest type
LANDIS 4x12 Type H Plain Hydraulic—latest type
LANDIS 10x48 Type C Plain Hydraulic—latest type
NORTON 12x36 Univ.; Hyd.—latest type
NORTON 24x240 Plain—motor drive
NORTON 23x72 Plain—latest type

● GRINDERS—Internal, Cutter and Miscellaneous

BRYANT No. 5 Internal—chuck.—latest type
BROWN & SHARPE No. 13 Univ. & Tool—latest type
CINCINNATI No. 2 Plain Tool & Cutter—latest type
CINCINNATI No. 2 Centerless—M.D.
HEALD 72A3 Sizematic
HEALD No. 70—Internal—motor drive
HEALD No. 81 Plain Internal—latest type
LEBLOND No. 2 Universal Tool & Cutter; latest type
PRATT & WHITNEY Contour Cutter; latest type
OLIVER Univ. and Tool
UNIVERSAL Spline shaft; Hydraulic

● BORING MILLS—Horizontal

CINCINNATI-GILBERT 3½" bar; floor type latest type
GIDDINGS & LEWIS No. 25T 2½" bar—latest type
GIDDINGS & LEWIS #360F—6" bar Floor type
LUCAS No. 31—3" Bar, No. 33—4½" bar—motor drive
LUCAS No. 42—4" Bar—latest type
NILES BEMENT POND, 5" Bar—floor type
NILES BEMENT POND, 7" Bar—floor type
NILES BEMENT POND, 4½" Bar—Duplex
UNIVERSAL 3" Bar—Timken Bearing—latest type
YODER #3—3" Bar—latest type—Timken Bearing

● BORING MILLS—Vertical

BETTS 120"—2-swivel heads, motor drive
BULLARD 2", 36", 42" New Era Type—motor drive
BULLARD 54" Spiral Drive; latest type
BULLARD 86"—2-swivel heads; motor drive
KING 72" 3-heads—latest type
KING 72" 2-swivel heads; motor drive
NILES BEMENT POND 84" 2-swvl. hds; M.D.
NILES BEMENT POND 120" 2-swivel heads; M.D.

COME TO "SUPPLY HEADQUARTERS"

LIQUIDATORS OF INDUSTRIAL PLANTS
•
REBUILDERS of MACHINE TOOLS

MOREY
410 BROOME ST.,

MACHINE TOOLS

NEARLY ALL BUILT SINCE 1941

● DRILLS

ALLEN #2, 2-4 spindles
ALLEN #3, single spindle
AVEY No. 2—3 spindles
AVEY No. 2—1 to 6 spindles
BUFFALO #16—4 spindle
HENRY & WRIGHT—2-spindle
LELAND & GIFFORD No. 1—1 & 2 Spindles
NATCO No. 12 Multiple Spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY No. 1/2Bx50"—2-spindle deep hole—latest type

● DRILLS—Radial

AMERICAN 4'11", 5'11"—latest type
CARLTON 3'11"—latest type
WESTERN 4'18", 5'18", 620"—latest type

● GEAR CUTTING EQUIPMENT

BARBER COLMAN No. 3 Gear Hobber
BARBER COLMAN Type A
BROWN & SHARPE No. 13 Gear Cutter
BROWN & SHARPE No. 6x60 Gear Cutter
CINCINNATI Gear Burnisher
FELLOWS No. 7, No. 7A, No. 77 Gear Shapers
FELLOWS No. 624A Gear Shaper—latest type
GLEASON 3", 6", 11", 18", Bevel Gear Generators
GLEASON 12" Bevel Gear Gen.; latest type
GLEASON 10", 15" Spiral Bevel Finisher
GLEASON Bevel gear tester
GLEASON 24" Bevel Gear Planer
G & E No. 96H Gear Hobber, with differential

● LATHES—Turret

BARDONS & OLIVER No. 3—latest type
CINCINNATI-ACME 5W Timken Bearing—latest type
GISHOLT No. 2L Univ. Timken Bearing
GISHOLT No. 3, No. 4 Univ. Timken Bearing—latest type
JONES & LAMSON No. 3, No. 5, No. 7C
MOREY No. 2G, 1" Cap. Timken Bearing
MOREY No. 3 Univ.; 1 1/2" Cap. Timken Bearing
MOREY No. 4 Univ.; 2" Cap. Timken Bear.
WARNER & SWASEY No. 1A, No. 2A, No. 3A Univ., Timken Bearing—latest type
WARNER & SWASEY No. 3, No. 4, No. 5 Univ. Timken Bearing—Latest type

● LATHES—Engine & Mfg.

AMERICAN 24"x14'—Timken Bearing
BRADFORD 26" x 14"—Timken Bearing
HENDEY 14x6' bed, geared head—M.D.
HENDEY 14"x42" Centers; Timken Bearing—latest type
HENDEY 12x54 Centers, Mfg. Type
HENDEY No. 3x54 Centers Mfg. Type
LEBLOND 12x30 Centers Timken Bearing, Latest type
LEBLOND 18x54 Centers, Timken Bearing, Latest type
LEBLOND 16"x102" Centers, Timken Bearing—latest type
LEBLOND 21x16' Bed, geared head
LEBLOND 20" x 48'—20" x 120 centers—Timken Bearing—latest type rapid products
LODGE & SHIPLEY 16 x 30 Timken Bearing—latest type
LODGE & SHIPLEY 18x8' bed, geared head
LEBLOND 17x9' and 14' bed Timken Bearing Rapid Production
MONARCH 10x20 Centers, Model EE, Timken Bearing Latest type
MONARCH 14x30 Centers, Timken Bearing, latest type
LIBBY 1H-5 Timken Bearing—Latest type
MONARCH 16x54 Centers, Timken Bearing, latest type
MONARCH 30"x10' bed, Timken Bearing
NILES 36"x18' Timken Bearing
REED PRENTICE 14x30 Timken Bearing—Latest type
SOUTH BEND 16 x 6 Toolroom lathe
SENECA FALLS 8"x60" LoSwing Timken Bearing—Latest type

● PLANERS

CINCINNATI 24" Crank—motor drive
CINCINNATI 36x30x5' Box table, PRT, 1 head—motor drive
CINCINNATI 120x96x20'—4 heads box Table, PRT—motor drive
CLEVELAND 48x48x16' Open side, 3 heads, motor drive
DIETRICH & HARVEY 48x48x16' 4 heads, Hydraulic—Motor drive
GRAY 48x48x16' 4 heads Motor drive
HAMILTON 42x42x20', 4 heads, motor drive
LIBERTY 24 x 24 x 48'—latest
LYND FARQUHAR 26" open side M.D.
NILES BEMENT POND 96x80x20' box table 4-heads Hyd. PRT. Motor drive

● AUTOMATIC SCREW MACHINES

CLEVELAND 7/8" to 2 1/2" Model A
CONO MATIC 3 1/2"—4 spindle—latest type

● PRESSES

CLEARING TYPE K-1200-30 Knuckle Joint, 200 Tons—latest type
CLEARING Type F-1100-36 Single Action 100 tons—latest type

● MISCELLANEOUS

CLEVELAND 12x16" Cutter Relieving Mach.
WATSON STILLMAN Hyd. Straightening Press 20 Ton
TREADWELL Pipe Threader 12"
MITTS & MERRILL No. 5 Keyseater
PEERLESS 6x6 Hack Saw—Auto. Feed
MARVEL No. 9, No. 9A Hack Saw
LUCAS #138 Old saw
LEBLOND #2 Deep Hole Borer
PRATT & WHITNEY No. 2A Jig Borer—latest type
MORTON 60" Combination Traveling head planer, milling & drilling

SPECIALS

MORTON boring, driling, milling and draw cutting traveling head planer 60" stroke

INGERSOLL 42 x 36 x 16' Plner Type Miller

PRATT & WHITNEY #2A Jig Borer—Ltest

MATTISON 16 x 24 x 96" High powered surface grinder

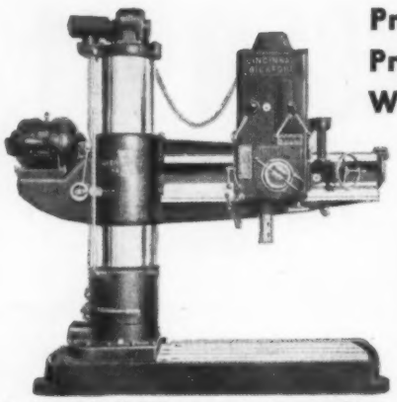
GOULD & EBERHARDT #96H Gear Hobber with Differential

PHONE, WIRE OR WRITE YOUR REQUIREMENTS

MACHINERY CO., INC.

NEW YORK 13, N.Y. • TELEPHONE CANAL 6-5360

Botwinik's Rebuilding Method, makes your machine tools do more for you!



Produce Faster!
Provide Greater Accuracy!
Work to Closer Tolerances!

1—Cin.-Bick. 7' 15" col., motor on arm, Super Service Pl. Radial Drill, max. dist. spin. to base 78", 18 feed changes, 36 spin. speeds, Morse Taper No. 5, AC elect. equip.

★ RADIAL DRILLS

Cin.-Bick. Radial Drills, M.D., (3) 3' 9" col., motor on arm, hi speed; (1) 4' 11" col. Pl.; (1) 5' 13" col.; (1) 6' 15" col. Pl.

★ VERTICAL BORING MILLS

Bullard 24", 36", and 42" New Era Type Vert. Bor. & Turn. Mills, M.D., capac.'s and diams. 26", 38", 44", heights under cross rail: 20", 24", 33", side heds.
1—Colburn 48" Vert. Bor. Mill, M.D., capac. 49½" diam. x 44" hght. under cross rail, 2 swiv. heds. on cross rail, power rap. trav.
1—Niles 53" Heavy, M.D., 2 swiv. heds.
1—Gisholt 52" Vert. Bor. & Turn. Mill, M.D., 54" diam. x 42" hght. under cross rail, comp. with right hand swiv. and left hand turret hed. on cross rail, horiz. and vert. rap. trav. to heds.

★ HORIZONTAL BORING MILLS

1—Ohio Med. 5F-420, 5" bar, floor type, Horiz. Bor. Mill, M.D., AC Motor Drive, power rap. trav., 18 spin. speeds, range: 6-200, taper in spin., Morse No. 7, long. trav. spin. 32", trav. hed. vert. 72", horiz. 120", new in '41.
1—Lucas No. 32 Horiz. Bor. Mill, Knee Type, M.D., diam. bar. 3¼", taper in bar, Morse No. 6, max. dist. spin. nose to act. support 72", tbl. wkg. surf. 30"x56".
1—Univ. 3½ Knee Type Bor. Mill, 3½" bar, No. 6 Morse Taper, size of tbl. 30"x48".

★ MILLERS

1—Milwaukee Med. 2K Pl. Miller, M.D., Ser. No. over 18/3590, dbl. overarm type, AC motor in base, very latest type, tbl. wkg. surf. 56"x12", range: long. 28", cross 10", vert. 17".
1—Milwaukee Mod. 2K Vert. Miller, M.D., Ser. No. over 31/3610, very latest type, tbl. wkg. surf. 56"x12", range: long. 28", cross 12", vert. 14", vert. move. of hed. 6", throat dep. 14".
1—B. & S. No. 3B Heavy Duty Pl. Mill. Machine, dbl. overarm type, AC motors in base, Ser. Nos. over 1630, tbl. wkg. surf. 55"x18", range power feeds: long. 34", cross 12", vert. 20".
1—B. & S. No. 3 Pl. Miller, Ser. No. over 1650, range: long. 34", cross 12", vert. 20" dbl. overarm type, AC motor in base, stand. spin., tbl. wkg. surf. 14"x60".
1—B. & S. No. 1A Univ. Miller, M.D., dbl. overarm type, AC motor in base, stand. spin., Ser. No. over 2960, tbl. wkg. surf. 11¼"x46¾", range: long. 22", cross 8", vert. 18".
4—B. & S. No. 2 Univ. Mill. Machines, M.D., tbl. wkg. surf. 45"x10¾", range: long. 25", cross 10", vert. 18".

★ LATHES

1—L. & S. 16"x8', 12 speed, select. grd. hed., Eng. Lathe, M.D., sw. over bed 18½", dist. btw. cens. 54".
1—P. & W. 16"x36" cens., Mod. B, 8 speed, grd. hed., motor in base, Eng. Lathe, sw. over bed 16½", taper attmts.
1—P. & W. 20"x48" cens., Mod. B, 16 speed, grd. hed., motor in base, Eng. Lathe, sw. over bed 21¼".
2—L. & S. 12"x6', 12 speed, select. grd. hed., pan bed, Tool Room Lathes, M.D., dual aprons, sw. over bed 15", dist. betw. cens. 36".
1—Niles 26"x18', grd. hed., Eng. Lathe, M.D., 11' 5" centers.
1—Bridgeford 36"x56', 15 speed, grd. hed., Eng. Lathe, M.D., AC elect. equip., power rap. trav. to carr., compound rest, 2 steady rests, sw. over bed 38", sw. over carr. 26", dist. betw. cens. 48'.
1—Hendey 16"x7' yoke hed., Eng. Lathe, M.D., taper attmt., collets, pan bed, sw. over bed 16", dist. betw. cens. 40".
1—Putnam 24"x12' dbl. bk. grd. Eng. Lathe, M.D., sw. over bed 27", dist. betw. cens. 67".
1—L. & S. 20"x6', 12 speed, select. grd. hed., pan bed, Eng. Lathe, M.D., sw. over bed 22½", dist. betw. cens. 46¾".

★ PLANERS

1—Cin. 72"x56"x20' Dbl. Hous. Planer, M.D., AC elect. equip., 2 rail heds., 2 side heds., rap. trav. to all heds., forced feed lub., herringbone gear drive.
1—Putnam 84"x84"x40' Dbl. Hous. Planer, Revers., M.D., and controls, 2 heds. on cross rail, 2 side heds., can be inspected in operation.
1—Cin. 48"x36"x12', Dbl. Housing Planer, AC Motor Drive, 2 heds. on cross rail, side hed.
1—Cin. 48"x48"x20' M.D., Planer, AC variable drive, 2 heds. on cross rail, 1 side hed., AC motor and controls.

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66", 120" Niles
54" Colburn, M.D., 2 hds.

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J. & L. 2¼"x24", 3¼x30".
Acme 3¼" M.D.
No. 1L Gisholt Univ. M.D.

GRINDERS
P. & W. 14", 18", B.B., Vert. M.D.
Blanchard 30", M.D.; Modern 12x48" M.D.
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Norton 50"x28', M.D.
Landis Type A 6x20" Hydraulic, M.D.
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12" Heald Rotary, Arter 12" M.D.
B. & S. No. 2 Surface, M.D.
Norton 10x36" Hydraulic, M.D.
B. & S. No. 10 1' Cyl.
No. 2 Cincinnati Centerless, M.D.
B. & S. No. 1, 3 Universal
#25, #35 G. & L. M.D.

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36x30' Putnam, M.D.
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32"x36' Wickes
Putnam 42x16', M.D.
30x26' L. & S. 12 speed M.D.
P. & W. 1x18, 1¼x18 Automatic Lathes

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B. & S. No. 00, 0
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7" Ammco Shapers
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4' Mueller, M.D.; 4' 5' Western, S.P.D.
4' American Hole Wizard

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No. 3S Cincinnati, S.P.D. rapid trav. M.D.
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Hall Planetary Model D Thread Miller
Providence Planer Type 32"x8'
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Kempsmith No. 1 Univ.

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6" Vertical Shaper, P & W
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MISCELLANEOUS

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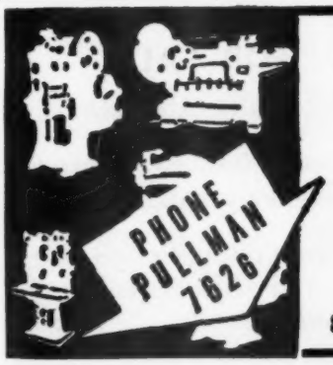

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3' Cincinnati Gilbert, motor on arm.
5 ft. Carlton Radial, enclosed head.
No. D2 Colburn, single spindle.
42" Barnes, sliding head.
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No. 11 Natco Multiple Drill, 16 spindle.
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★ **15" x 30" Lipe Carbo-Matic, new 1943.**

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No. 4A Brown & Sharpe Universal, s.p.d.
No. 3B Milwaukee, plain, m.d.
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No. 1 Brown & Sharpe Universal, m.d.
No. 0-8 Cincinnati Plain Automatic, m.d.
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3' 9" Cincinnati-Bickford—1942
3' 11" American—1942
3' 9" Cincinnati-Bickford—M.D.
5' Western—M.D.
21" Royersford—B.G.—Upright
Natco #D5 Multiple Spindle—M.D.
Canedy-Otto #16 Royal Bench—new

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Norton Cam—M.D.
Reid #2B Auto. 6x18 Surface—new
Cincinnati #2 Centerless—M.D.
H & G Chaser—M.D.
Porter-Cable #86B Sander—1942
Gronby Bench-Internation—M.D.—1942

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14"x6' American—G.H.—T.A.
24"x10' Blaisdell—L.C.G.—T.A.
14"x8' American—12-speed—G.H.—motor in base—T.A.—collets
#2 Warner & Swasey—G.F.H.—M.D.—Bar feed—Turret
21" Gisholt—Universal—Turret

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#2B Milwaukee Universal—all geared
#2B Brown and Sharpe Plain—all geared
#26 Van Norman Duplex—1942
#22L Van Norman Duplex—1942
24" Cincinnati Duplex—1938
#2M P&J Dual table—M.D.
#3V Van Norman Vertical
Brown and Sharpe #2 Light type—Vertical—1942

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36x36x8' Powell—1 side head and 1 rail head
30x30x10' Putnam, two rail heads
36x36x12' Niles, Bement, Pond—two rail heads, rapid traverse to heads—M.D.

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22" Buffalo Pr. Fd. Motor Drive, New
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Magic Chucks, #1-2 & 3 and Collets
Pipe Machine, 8" Oster motor drive
Planer 24"x24"x8' Pease, motor drive
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Turret Lathe, 2" Acme & Warner & Swasey
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Bliss No. 306½	150	27 x27	3-6"	Clearing No. F-1700	700	58 x58	12-18"
Bliss No. 7	180	36 x28	1½-4½"	Clearing No. K-1800	800	60 x60	3-8"
Bliss No. 87½	215	28 x28	28"	Bliss No. 26-A	800		
Bliss No. 89A	300 plus	38 x38	16-30"	Bliss No. 615D Hi-Sp.	20	14 x 9	2-4"
Bliss No. 6	100	29½x24	4½"	Cleveland 34-S	1800	60 x56	40"
Clearing F-1100-36	100	36 x36	12-18"	Bliss No. 5½	113	33 x42	4½"
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Nos. 3-4-5 Nat. Hi-Sp. Maxipress

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Elmes	250	24 x24	30"	Bliss	2500 (6 side type)	96 x36	40"
Elmes	375	84 x66	36"				
Elmes	600	66 x45	36"	Woods	2500	18' x 8'	18"
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Lake Erie	1320	80 x60	36"				

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#36 Van Norman Ram Type Plain Miller
#2KM Milwaukee Dial Type Vertical Miller
#2HS Cincinnati Dial Type Vertical Miller
#36 Hanchett Surface Grinder 40" Chuck
#18 Blanchard Surface Grinder 30" Chuck
8"x48" J&L Automatic Thread Grinder
#13 Brown & Sharpe Universal Grinder
24"x120" Monarch Model "N" Lathe
3'-9" Cincinnati-Bickford Radial
3'-11" Carlton Radial
4'-13" Cincinnati Bickford Radial

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AUTOMATICS, Gridley, ¾, 1¼, 1¾, 2¼" & 2¾ Model F, M.D.
AUTOMATICS, Gridley, 2¼, 3¼, & 5¼" M.D.
AUTOMATICS, Cleveland 1¼, 1½, 2, 2½, 3½ & 4¾" Model A, M.D.
AUTOMATICS, Cleveland ⅞, 1¼, & 2" Mod. B
AUTOMATICS, Potter & Johnston #5a & 6a, M.D.
BULLARD, 36" New Era Borg Mill, M.D.
CONOMATICS, 1½" & 1¾"—6 spindle, M.D.
DRILLS, High Speed B. B. 1 to 6 spindles
GEAR HOBBERS, #3 & 12 Barber-Colman, M.D.
GEAR SHAPERS, #7 High Speed, M.D. & #6
GENERATOR, Gleason Spiral Bevel Gear 10"
GRINDERS, Brown & Sharpe #2 & 3 Universal
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72 Hydraulic, 2 M.D.
GRINDERS, Diamond Surface #2, M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
GRINDERS, Landis Hydraulic, 6"x18", M.D.
GRINDERS, Pratt & Whitney 12" Vert. Surface
LATHES, Hendey, E.B.M. type, 14"x7' & 8' M.D.
LATHES, Hendey, 16"x8' & 8' & 18"x10' M.D.
LATHES, Reed-Prentice, 24"x12' G.H. M.D.
LATHES, Rockford, 18"x8' Geared Head, M.D.
LATHES, Turret, Warner & Swasey #4 G.H. M.D.
LATHES, Morey #3 G.H. Turret, M.D.
LATHES, Lo-Swing 4"x36" Seneca Falls
MILLING MACHINES, #2B Milw. & Vert. Hd.
MILLING MACHINES, Becker Vertical #5 & 6
MILLING MACHINES, Milwaukee #1B Plain & Universal 1A #2 & 3B Plain, M.D.
PLANER, Gray 30"x30"x8' two rail Hds.
PLANER, Ohio 42"x42"x10' One Head, M.D.
TAPPERS, Garvin #2 & 2X, M.D.
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B. & S. No. 13 Univ & Tool.
Abrasive No. 33.
Norton 6"x18" Hyd. Surface.
Norton 15"x15"x72" Surface.
Norton 6x32, 10x24, 10x50 Plain.
B. & S. Nos. 10, 11, Plain; Nos. 1, 2, 3, Univ.
Bryant Nos. 3B, 5, 6, 12 Internal.
Landis, 12"x32", 20"x120"; 20"x144" Plain.
Cincinnati No. 1½ Tool & Cutter.
Norton No. 2, Tool & Cutter.
Cincinnati No. 2 & No. 3 Centerless.
Fitchburg 36" Spline Grinder.
Blanchard No. 16—30".
P. & W. 14" Vert. B.B.
Barber Colman #3 Hob Grinder.

LATHES

American 18"x12'—G.H.
Hendey 20"x72".
Lodge & Shipley 20"x8', G.H.

MILLERS

K. & T. #S 2H & 3H Plain.
Cin. No. 2 Universal.
B. & S. No. OY Production.
Cin. No. 2 Plain; Nos. 3, 4 Vert.
B. & S. No. 3B & 5B Plain.
Rice-Barton 4" Spline.
P. & W. 8", 10" & 12" Automatic.
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Cincinnati No. O-8, New 1942.
P. & W. 6x14 & 6x72 Thread.
B. & S. No. 12 Double Overarm Production.
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Powell 48"x48"x12', 4 Head.

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Ferracute No. DG-5.
WF 300 Ton Cap. Geared.

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Potter & Johnson No. 6-C Chuckers.
Cleveland 1⅜" Model AA.
W. & S. Nos. 4, 2A, 3A Univ.
Foster No. 7 and No. 1B.
Oster No. 601—1¼" Cap.
Cone 1¼" & 1½", 4 Spindle.
Cleveland 3¾" Model A, Latest Type.
Cone 3½"—4 Spindle.
Cleveland 6¾" Model A.
Cleveland 7¾", Model A.
Gridley ⅞", 1¼", 1¾" and 2⅝", Model G.

MISCELLANEOUS

Borematic-Heald #47-A.
Boring Mill—Gisholt 30".
Boring Mill—Bullard 42" New Era.
Boring Mill—Bullard 100" 2 Hd.
Boring Mill—Bertran 42".
Cutoff Machine—Abrasive No. 213 Hyd.
Fay Automatic
Gear Shaper. Fellows #7.
Hammers—Bradley.
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Manning, Maxwell & Moore 70' Span
Manning, Maxwell & Moore 47'4" Span
Shaw 36' Span
Champion 37'6" Span
American 70' Span
American 47'4" Span
6-TON—P & H 77' Span
American 77' Span
7½-TON—Shepard 36' Span
10-TON—Shaw 68' Span
Shaw 73' Span
P & H 30' Span
P & H 87'6" Span
P & H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'8" Span
Morgan 39'5" Span
Morgan 52'3" Span
Milwaukee 68'9" Span
McGill 85' Span
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Emsco 75' Span
Dominion 35' Span
Cleveland 36'½" Span
Cleveland 50' Span
Alliance 71'10½" Span
Alliance 58'9" Span
Albany 60' Span
15-TON—Whiting 71'-10½" Span
Northern 53' Span
Erie 60' Span
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P & H 51'4" Span
Northern 60' Span
Morgan 90' Span
Cleveland 65' Span
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P & H 70' Span
Morgan 52'3" Span
Cleveland 106' Span
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30-TON—Whiting 88' Span
P & H 80' Span
P & H 60' Span
Morgan 30' Span
Case 41' Span
35-TON—Bedford 59' Span
Northern 22' Span
50-TON—Shaw 95' Span
Shaw 69'10" Span
Dominion 80' Span
Cleveland 71'10½" Span
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Grinder, Covel Surface No. 15, M.D.
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Grinder, Heald Internal No. 70A
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Lathe, LeBlond Heavy Duty Automatic No. 12
Lath, Lodge & Shipley 16"x8', geared head, M.D.
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Mill, hand, Kent Owen No. 1, M.D.
Mill, Rockford Rigidmill, M.D.
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1—8½ x 16' Hardinge #200 Precision Lathe
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1—Racine Hacksaw 6 x 6
3—Kent Surface Grinders 18 x 6 x 9½
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1—#1 Boyar Schultz Profile Grinder
1—Bliss 50 ton Screw Tryout Press
1—Royersford #12A Kick Press
6—#15 Buffalo Drills
1—Fosdick Sensitive Single Spindle Drill
1—Hi-Eff Precision Drill
1—30" Single Spindle Heavy Drill
1—#15 Buffalo Floor Type Drill Press
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2—Harvey Butterfly Filing Machines
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Latest models, little used!

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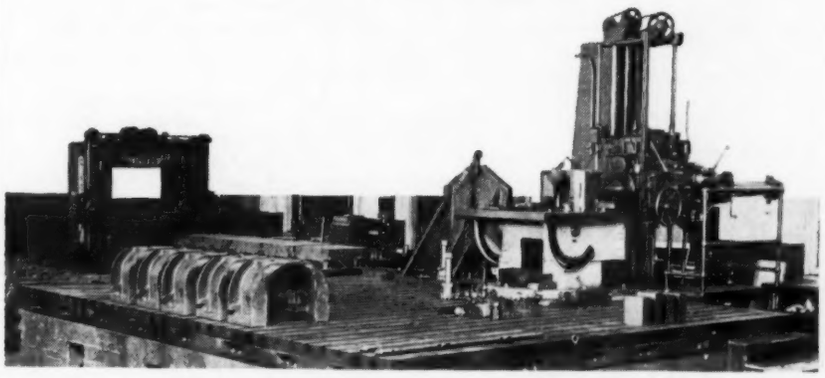

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6.2" Denver, chucking machine
No. 6R Denver Univ., 2-9/16" capacity
18" Libby, 3½" Hole in Spindle
No. 4 Warner & Swasey
No. 2 American Brass Lathe

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1⅝" Conomatic, 8 spdl.

MISCELLANEOUS

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Oliver Ace Univ. Tool & Cutter Grinder
No. 27-MB Smalley-General Thread Miller
No. 6 Lees-Bradner Thread Miller
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10 x 18	10 x 96	16 x 50
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6" x 18" Norton hydraulic
6" x 18" Landis Type C hydraulic
6" x 20" No. 10 B&S Elec. hydraulic
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12" x 36", 16" x 36" & 16" x 72" Landis
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10" x 36" No. 2 Bath univ.
18" No. 6 Besly type I opposed spindle
36", No. 18 Blanchard surface
16", No. 10 Blanchard surface
14" Pratt & Whitney vert. surface
6" x 18", No. 2 B. & S. surface
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No. 104 Rivett internal
No. 72A3 Heald Sizematic internal
No. 75A Heald, cross feeding head
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20", No. 120A Gardner opposed disc
No. 2 Cincinnati centerless

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10x48" Landis Type C Hydraulic, m.d., latest
10x48" Norton Type C Hydraulic, m.d., latest
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10x72" Norton, m.d., latest
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12x36" Modern, belt
12x36" Cincinnati, belt
12x42" Landis, belt
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12x72" No. 16 Brown & Sharpe, belt
12x98" Landis, m.d.
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14x48" Cincinnati-Self-Contained, m.d.
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No. 2 Cincinnati, m.d., 1942 machine
Cincinnati No. 2, m.d.
Cincinnati Valve Seat Grinder, m.d.

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No. 2—12x30" Brown & Sharpe, belt
12x36" Cincinnati, belt
16x68" Landis, belt

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No. 50 Heald, m.d., brand new
No. 55 Heald, m.d.
No. 60 Heald, belt
No. 65 Heald, m.d.
No. 73 Heald Airplane Cylinder, brand new

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No. 16RS Bryant, latest
No. 6, 10, 20 Bryant, belt
No. 24-20" Bryant Hydraulic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 74 Heald, m.d.
No. 9 Cincinnati, belt

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1—36" x 36" x 8' to 12' Ingersoll Planer type Miller with one horizontal head on rail and 2 side heads.

1—54" Bullard "Cut-master" Vertical Boring Mill.

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1—#3B Pratt & Whitney Die Sinker—1941 or newer.

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110—Motors, 1 HP, 1750 RPM, 220/3/60. General Electric preferred. New or used.

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1 Mechanical Crank Press, 500 ton, 20" stroke, 72 x 120" bed, 50 x 112" bed opening, 2 air cushions, 10 strokes per minute, 48" shut height, 18" stroke adjustment.

Above specifications are approximate and any press of this general description will be considered.

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BARDONS & OLIVER #7 Univ.; Timken Bearing; chucking
FOSTER #3F Univ. Fastermatic; Timken Bearing

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NILES 30"x50' NILES 30"x46'

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PRATT & WHITNEY 14"x60" Vertical Surface—Hydraulic
HAMMOND Type WH Model A Pedestal Grinder
FOX #8 Swing Frame

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PEERLESS 14"x14" Hack
CAMPBELL #401 Cutamatic Wet Abrasive Cutting Machine 6"

MILLING MACHINES

HALL Planetary Millers, Style C & D
KENT-OWENS #1M Hand; ball bearing, M.D.

BORING MILLS—VERTICAL

NILES 42", 2 swivel heads, power rapid traverse

MISCELLANEOUS

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BRINELL Automatic Direct Reading Hardness Testing Machine
SUTTON #2 Single Head Horiz. Straightening Press, to straighten up to 6½" bar.
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BLISS #6 Arbor Press
RHENBERG-JACOBSEN Centering Mach.

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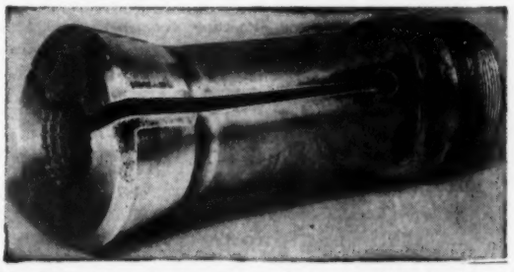

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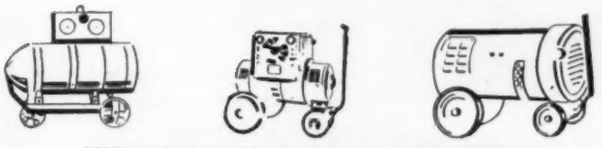

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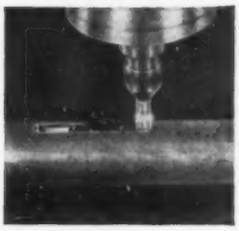

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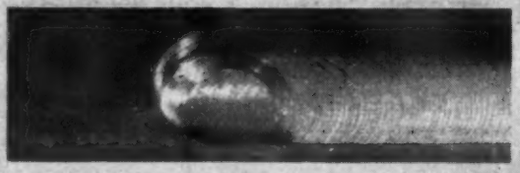

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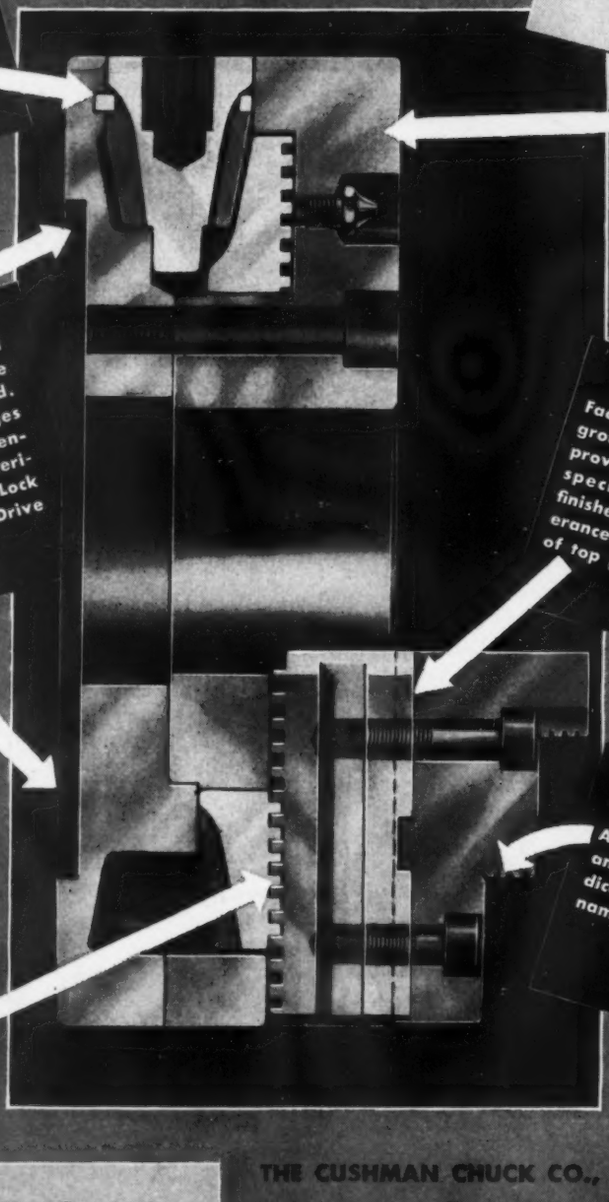

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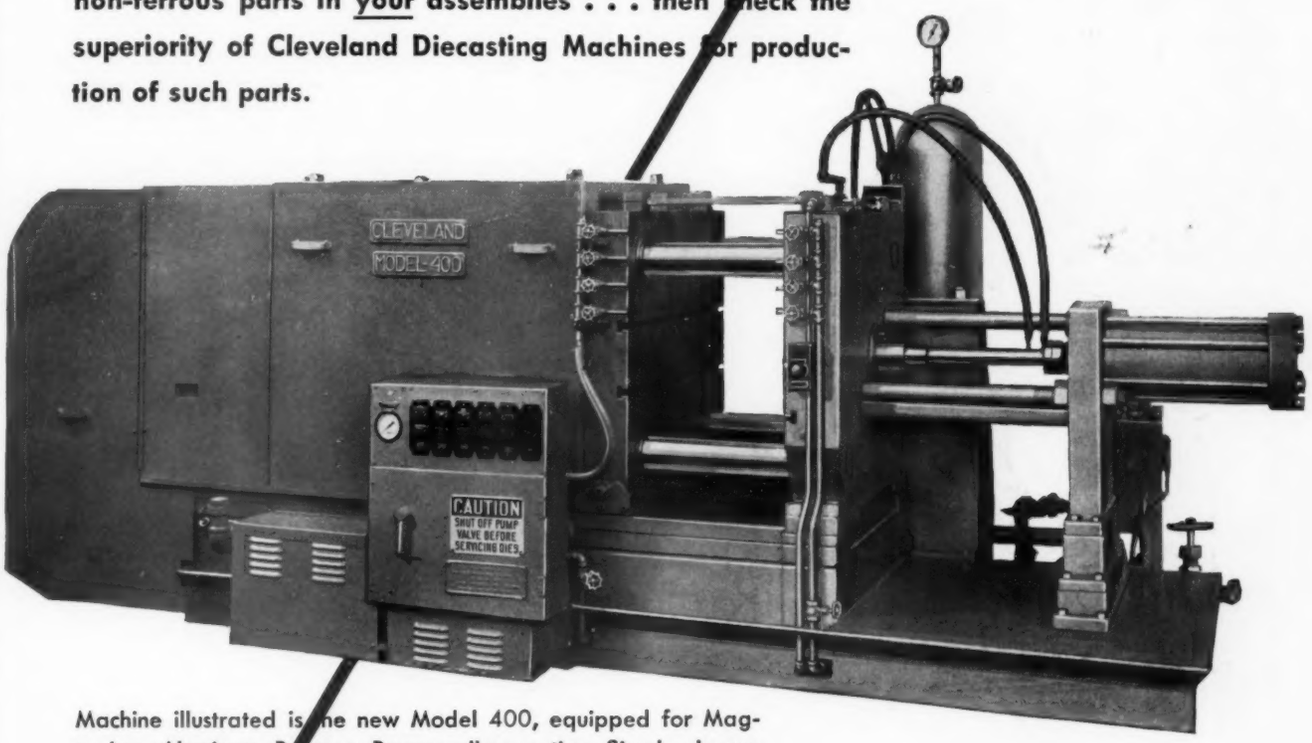

Machine illustrated is the new Model 400, equipped for Magnesium, Aluminum, Brass or Bronze alloy casting. Simple change of the hot metal end equips same machine for casting Zinc, Tin or Lead alloys. *Ask for Bulletin D446.*

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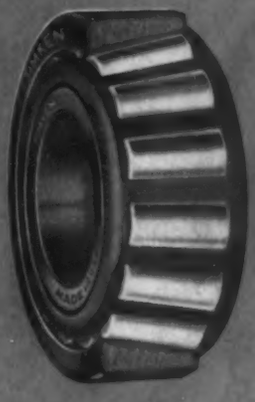

As shown in the photograph this machine is tooled for end facing and chamfering tubes 4 feet long, 6" O.D., ⅛" wall thickness at 640 per hour. The tubes are carried in an automatic reel feed; each tube is held in position by two automatic chucks while the spindles advance and work on both ends simultaneously; 4 Timken Bearings are applied in each operating head.

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